Cardio Menu

Operator Manual

Welch Allyn®

Service Manual

PneumoCheck™

Spirometer Model # 61000,

Printer Charger #'s 76100 & 76106

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Part 610132

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Help Information:

- All service and repairs must be performed by authorized Welch Allyn personnel or agents, using Welch Allyn replacement parts. Failure to do so will invalidate the product warranty.

- If you have any questions about servicing the 61000 Pneumocheck or the 76100 or 76105 Printer Chargers, please call or write Welch Allyn:

Attn: Product Service Department
Welch Allyn, Inc.
4341 State Street Road
Skaneateles Falls, NY 13153-0220
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Telephone: 800-535-6663
Fax: 315-685-4653

- **Troubleshooting assistance is contained in Section 4 of this manual.**

- Please read and understand the PneumoCheck and Printer/Charger Operating Instructions PN 610140-3.

1.1 Basic Description - Handheld Spirometer

1.2 Basic Description - Printer

General Information

1.1 Handheld Spirometer

Refer to Owners Guide P/N 610140-3

The handheld spirometer is a small, battery operated device incorporating a laminar flow sensing pneumatic liquid crystal display, and electronic circuitry in an injection molded case.

The front panel of the handheld spirometer includes the eight character, alphanumeric display, two push-button keys labeled **TEST** and **DATA**, an **ON/OFF** slide switch and a battery charge indicator light. The flow sensor is housed in the top portion of the device and is removable for cleaning and sterilization. The mouth piece is at one end of the flow sensor and fits disposable cups or disposable cardboard tubes. There are two electrical contacts on each side to the spirometers batteries. On one side of the spirometer is a DC jack for battery charging in case the operator chooses not to purchase the optional printer base.

The main function of the handheld spirometer is to gather data from two kinds of spirometry maneuvers by patients: the **FVC maneuver** and the **MVV maneuver.**

The **TEST** key is used to select and perform the desired test. It is normally pressed when the spirometer is displaying the word **SELECT.** It can also be pressed during a maneuver or during the results display to prematurely quit a test and begin another.

The **DATA** key is used to continue whenever the device pauses to display some information. When the word **SELECT** is being displayed, the **DATA** key can be used to show the results of the test that is currently stored in memory.

The general flow of usage of the device starts with the selection of a test. The operator then waits for an audible beep, indicating that it is ready to acquire data from the maneuver. The patient puts the mouth piece to his mouth and performs the maneuver. Upon completion indicated by another audible beep, there is a brief delay while the results are calculated then the result messages are displayed. This completes the loop, and the machine goes back to **SELECT** and waits for another keypress.

When not in use, the handheld spirometer sits-in the cradle of the printer base (or it is connected to an outlet via a DC power adapter,) and the battery is charged. The battery indicator light remains on whenever a source of charge current is present. The spirometer becomes operational when it is lifted from the printer base or disconnected from the DC adapter. The spirometer is functional only while disconnected from the charger or printer base and the **ON/OFF** switch is **ON.** The word **SELECT** appears on the display and the device waits for a keypress from the operator.

When the word **SELECT** is on the display, you can do one to the following:

1. Press the test key which will start the sequence for doing an **FVC** test, and **MVV** test, or a calibration of the spirometer.

2. Press the **DATA** key which will display the test values of the best test of a test is currently stored in the spirometer's memory.

3. Put the spirometer back into the printer cradle which will start the sequence for transmitting any test data in the spirometer's memory to the printer's memory, and then resume charging the battery.

4. Connect the spirometer to the DC power adapter, which will resume charging the battery.

5. Turn the unit off using the **ON/OFF** slide switch.

A more detailed description of the operation of the spirometer is contained in the Operator's Manual.

1.2 Printer

The printer base consists of a receptacle to hold the spirometer, a battery charging circuit, a high speed thermal line printer, and associated microprocessor a power circuitry, all housed in an injection molded case.

The front panel of the printer includes 2 indicator lights, and 3 push button keys marked **STOP, FEED,** and **PRINT.** Also on the front panel are 5 numeric rotary switches: 2 digits for **AGE**, and 3 digits for **HEIGHT**. The are also 2 slide switches for selecting **SEX** and **RACE**.

There is a set of 4 option switches located on the underside of the unit.

The main function of the printer base is to print reports of spirometry tests performed by the handheld spirometer, and to charge the spirometer's battery.

The general flow of usage is as follows:

When the spirometer is placed in the cradle of the base, it immediately begins sending data to the printer base during which time the message **SENDING** appears on the panel of the printer base. Once the data transfer is complete, the printer base gives a compound beep and continues to charge. The **READY** light on the printer base turns on solidly, indicating that there is a test stored in its memory. The operator then sets the patient demographic switches for the patient, then presses the **PRINT** key to print the report.

There are two indicator lights on the front panel of the printer base. One is labeled **POWER** and is on whenever the unit is plugged into a powered outlet. The other light is labeled **READY**, in the memory of the printer base. When the device is receiving data from the spirometer, this light flashes. Once the transfer is complete and test is in memory, the light remains on.

The **READY** light is also used to indicate an error condition. Errors are numbered from one to three. When an error occurs, an alarm sounds and the **READY** light flashes in groups of 1, 2, or 3 flashes (at a rate of times per second), corresponding to the error that was detected. A one second pause occurs between these flashes. This continues until the error condition has been cleared.

The **PRINT** key is used to print a report. If there is no report to be printed and the **PRINT** key is pressed, a short chirp will sound and no report is printed.

The **FEED** key is used to feed paper out of the printer. The paper is fed as long as the key is held down. The key is not operable while a report is being printed or while the data is being transferred from the spirometer.

The **STOP** key aborts the current task (report printing or data transfer) and returns to the wait state of the base. It is also used to clear the machine of any error condition that it might be in. It does not clear the printer base's memory.

The demographic switches are used to indicate the patient's age, height, sex, and race. The **AGE** switch consists of two digits, each of which can range from 0 to 9. The range of valid values depends on the normal being used.

The **HEIGHT** switches operate in the same manner as the **AGE** switch, except that it has three digits. Either inches or centimeters can be used for the height. As was the case for **AGE** the range of valid values depend on the normal being used.

If the value for either age or height fails outside of valid range, then the normal values are not calculated or printed on the report.

The **SEX** switch is a slide switch. The up position indicates the patient is a female, while the down position indicates that the patient is male.

The **RACE** switch is also a slide switch. The up position indicates race group 1 and the down position indicates race group 2. Race group 1 is used if the patient is Black, Oriental, East Indian, or Pakistani. Race group 2 is used for all other races.

There are four option switches located on the underside of the printer base. The switches are dip switches that can be in either the **ON** or **OFF** position. These switches can be changed while the printer base is on. The options specify certain aspects of the report printing. They are:

1.	**OFF**	
2.	**OFF**	Knudson, 1983
1.	**ON**	
2.	**OFF**	Knudson, 1976
1.	**OFF**	
2.	**ON**	Morris, Crapo et al
1.	**ON**	
2.	**ON**	European

3. **OFF**: Short report form
3. **ON**: Long report form

4. **OFF**: Flow/Volume plot
4. **ON**: Volume/Time plot

These options are discussed in further detail in the Operator's Manual.

Service

2.1 Bench Test of Pneumocheck

2,2 Bench Test of Printer/Charger

2.3 Required Tools and Equipment

2.4 Test and Adjustment Procedures

2.1 BENCH TEST OF PNEUMOCHECK

SECTION A

Caution: Adequate ESD protection must be worn at all times when working on the Pneumocheck, handle or printer/charger.

1 Remove pneumotach if necessary.

2 Obtain a good set of batteries and insert in pneumocheck.

3 Replace pneumotach. Turn pneumocheck on. If unit powers up continue testing (steps 3 & beyond). If unit doesn't power up, take apart. Refer to troubleshooting guide.

4 Put into data mode (hold down white button, turn unit on and release white button).

5 Observe LCD; all segments should be on.

6 Depress and release 'test' button. Unit should step through a self diagnostic.
Testing > ROM OK > RAM OK > EEPRM OK> ASLEEP

In 'ASLEEP' mode, the unit will stop and await further instruction.
If unit stops before sleep mode, there is a failure. Refer to troubleshooting guide.

7 Depress & release test button: ON reading should be displayed. It should read between 30 and 80. Continue testing whether on reading is in range or not.
Calibration of this circuit will be covered in SEC B, STEP 6.

8 Depress & release test button: Unit should give BAT reading. This should be 815 +/- 1% (807-823). Even if number is outside of range, continue on to steps 9-12. Refer to troubleshooting guide to diagnose after completing step 12.

9 Depress & release test button: Ambient temperature should be displayed.
20 degrees C = 68 degrees F
22 degrees C = 72 degrees F
24 degrees C = 75 degrees F
25 degrees C = 77 degrees F
27 degrees C = 81 degrees F
30 degrees C = 86 degrees F
If unit displays a reading outside ambient temperature range, complete steps 10 thru 12. Then, refer to troubleshooting guide. If unit displays a reading of 390-400 degrees F, check battery voltages. If battery voltage is low, replace battery and repeat steps 4 thru 12.

10 Depress & release test button: Unit should read FO = 55. This is a software coefficient.

11 Depress & release test button: Unit should display a flashing 'BAT OK' message.

12 Depress & release test button: Unit should display 'DO DCV' message.

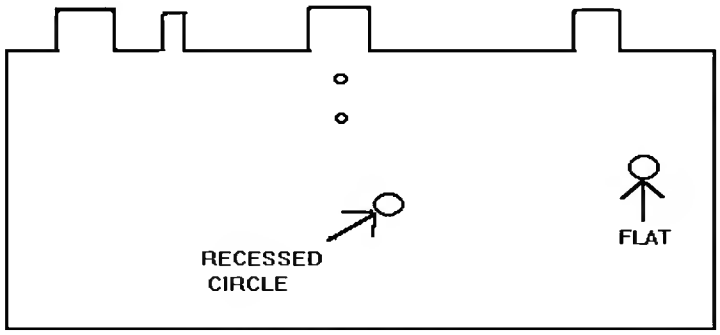
13 Turn unit off. Depress test button and turn unit on, release test button. Unit should read: 'Test Mode' >VER.3.5 >clear > select. The latest software is VER 3.5: If unit reads VER 3.2, the software must be changed. The PROM is part no 610102-535. It goes into position U4 of the LCD digital PC board.

SECTION B

Disassemble Unit:

Wear ESD wrist strap when performing the following operations.

1 Observe backplate; notice what must be present:



INSIDE OF BACKPLATE

If there is a raised surface where the 'flat' should be and/or if there is no recessed circle, replace backplate (610015-503). Remove battery holder before discarding old backplate.

NOTE:Observe back of LCD board. If back of LCD board does not have a metal bar, you must replace this board.

2 Apply a moderate amount of force to the side of each battery contact. Contact should hold firm. If it does not, take battery contact off and clean any dried epoxy off of metal conducting surface on PC board.
Obtain a new battery contact (610067-1) and solder to PC board, noting proper positioning.

Before soldering, screw contact onto PC board with appropriate hardware.

Lastly, tighten to specifications (approx. 12-16 in/oz.) or until moderately firm. Take note that black fiber washer is not destroyed. Perform this step whether epoxy was adequate or contact had to be soldered.

3 If required, change Red LED to orange (230015-6).

4 If necessary, change software. You must remove digital board from front plate to do this. PROM is location U4 on digital board.

5 If necessary, reverse side contacts. To do this, remove the two metal contacts from the black plastic piece. Reverse the plastic piece so that metal contacts will be raised outside of plastic surface of main frame. Do this for each side.

6 Calibrate the transducer circuit: to get to ON reading, see steps 4-7 section A. If ON reading was in spec.(see step 7, section A), set to 50 or as close as you can get (within 5 cts.), using R33 (pot at bottom of PC board).

Apply 58.8 DPA (60 mm of water with manometer) to transducer via long hose.

Adjust R36 (pot just above R33) to 844 +/- 5 cts. Return to ODPA, reading should be 50 +/- 5 cts. Readjust if necessary.

If the transducer reading is outside of the 30-80 range, measure the transducer output ofpins 2 and 4 of the transducer. They are the two white wires coming from the transducer. You should see no more than approx. 300 micro volts (.3mv). If this is the case, readjust ON reading to spec. as per sec. B, step 6.

If you see more than 300 mcvolts (.3mv), replace transducer.

If you cannot build pressure in transducer, diaphragm is torn, replace transducer.

Once transducer is replaced, calibrate according to Section B, step 6.

Once transducer is calibrated, re-assemble unit.

7 With unit assembled and good batteries in, without the pneumotach (top piece), insert into working printer charger. With a DC ammeter, measure current between the top of each battery. You should see approx. 11 ma recharge current.
If reading is outside of 10-12 ma, refer to troubleshooting guide.

8 If reading is good, assemble pneumotach onto handle. Obtain final test form.
Step through, test in 'DATA' mode as per Section A, steps 4-12 .
Observe 'ON' reading . As you do this and write down in appropriate place on form.
Continue to move forward until you see DO DCV.

At this point throw switch on test printer to RXTX OK position. This puts a short circuit between the RX and TX communication lines. Insert handle. The following messages should appear:

DCV SEEN > RXTX OK > CHARGE > screen blank.

If they do, remove handle, the message DO DCV should re-appear. Return switch on test printer to RX fail position.

These tests are taken from spec. A01943 Rev.F.

Get ready to calibrate w/3.0 liter syringe according to spec. A01945 Rev.D.

2.2 Bench Test of the Pneumocheck Printer/charger

1. ESD protection is required whenever working with the pneumocheck printer.

2. Apply power to the unit. It should beep twice and the "power LED" will light. The "data" light should not be lit.

3. Note and record "dip" switch settings if customer owned. These switches will have to be returned to these positions when testing is complete.

4. Check printer well to make sure there is no foam pad. If there is one, it must be removed. Make sure printer is powered down. Remove pad by walking and rolling back pad from ends. Move slowly as to not tear the pad if possible. Continue until pad is removed. Clean remaining adhesive with an adhesive remover solution. Try to avoid scratching the printer well plastic piece.

5. Complete the following tests: A .
With a DVM set on the 200VDC range, measure 14vdc across contacts as shown below that are marked with an (**).

B. Check voltage between ground contact in printer well and pin 8 of the J2 connector. The J2 connector is the longer of the two groups of pins in front of the printhead. Pin 1 is at the left end of the longer group, counting left to right. The voltage should be between 4.75 and 5.75 vdc.

C. Check voltage between ground contact in printer well and pin 1 of the J2 connector. The voltage should be 24vdc +/- .5 volts.

D. Install a paper roll if one is not installed. Measure the dc voltage between the ground contact in printer well and pin 3 of the J1 connector. The J1 connector is the smaller of the two groups of pins in front of the printhead. Pin 1 is on the left, counting left to right. The voltage should be 3.00 vdc or less.

6. Making sure the red capped lever at right of printhead is pushed all the way toward the back of the printer, hold down the feed button. The paper should advance steadily forward.

7. Hold down feed button, then press and release the stop button. The paper should automatically feed in the reverse direction. Release the feed button. Paper will stop feeding.

8. Push the print button. The unit should beep, indicating that it has no data. The data light should remain unlit.

9. Download data into printer by placing spirometer handle, in on state, with data in it, into the printer well. The data light should flash repeatedly for several seconds. After this, the data light should be lit.

10. Make sure all dip switches on bottom of printer are set to the "off" position. On top of printer, set the following: Age: 36; Height: 159; Race: 2; Sex: F.

    Depress and release the print button to obtain a printout. The printout should agree with the settings. Also, the standard printed should be Knudson 1976 (dip switches 1 and 2 in off position), short form (dip switch 3 in off position), and the flow over volume graph (dip switch 4 in off position).

11. Set dip switches on bottom of printer to "on" position. On top of printer, set the following: Age: 59; Height: 96; Race: 1; Sex: M.

    Depress and release the print button to obtain a printout. Observe printout. The printout should agree with the settings. Also, the standard should be Euro CCS (dip switches 1 and 2 in on position), the long form, which is a questionnaire (dip switch 3 in on position), and the volume over time graph (dip switch 4 in on position).

12. Return dip switches to position they were when unit came in from customer. If unit is a loaner, or a new unit being returned to stock, set all dip switches to off position.

13. Hold down the print button and press/release the stop button. Release the print button. A test printout should print. At right side of top line, check the version of software. It should be V3.2. If it is V3.1, it needs to be changed. The "PROM" that controls this is in position U5 on the main pcboard. Replace existing Prom with part number 610102-506. This Prom is software version V3.2.

14. Perform agency tests on printer. These include the ground continuity test and the leakage current test. If the main pcboard, transformer or line filter was replaced, perform the hypot test. Observe standards. They are:

    Ground continuity test: .2 ohm maximum resistance with 10 amperes of current flow through the earth ground line from the wall plug to a distant metal point on the unit, probably the transformer screw opposite where the ground wire is connected;

    Leakage current test: 100 microamps or less from any dead metal part on printer to earth ground, with the printer ungrounded and powered up.

    Hypot test: 1200 vac across the hot and neutral (tied together) and earth ground for one second without breakdown (voltage reduction).

15. This concludes the printer bench test. Make sure there is an ample supply of paper in printer. When loading paper, feed about 2-3 inches, put leading edge of paper through paper cutter envelope before putting paper cutter in place. Any questions call Welch Allyn Technical Service at 800-535-6663, Technical Support.

2.3 Tools and Test Equipment Listing

Required Tools:

1. Compression ring tool - Welch Allyn tool number **T8608**
2. Snap ring pliers (external) VACO #22
3. #1 Phillips head screwdriver
4. 1/4 inch flat head screwdriver
5. 3/32" Hex Key

Required Test Equipment

1. Merriam M131 Manometer with C34259 mount kit or Welch Allyn Pressure Applicator Box.
2. Pressure Source - Welch Allyn number **T9161**
3. 0-7VDC Power supply with 100 mA current limit
4. 0-14VDC Power Supply
5. 0-50mADC ammeter
6. 0-14VDC voltmeter

2.4 TEST AND ADJUSTMENTS

PNEUMOCHECK HANDLE

A set of specification drawings have been included in Section 7 with reference made to them here. The following tests should be done before the unit is returned to the customer.

1 Calibrate and test the handle per specification drawing A01945. "Calibrating with Welch Allyn Spirometer.

2. Perform all tests on specification drawing A01951, "Dynamic Waveform Testing"

For troubleshooting use, specification drawing A01943 has been included for testing at the PC Board Level.

PNEUMOCHECK PRINTER/ CHARGER

1. Perform Dielectric Strength Test per:
   A00167- UL/CSA Models
   A00178- IEC Models

2. Perform Leakage Current Test per A00171

3. Perform Grounding Continuity Test per:
   A00172 - UL/CSA
   A02242 - IEC

4. Perform all tests listed on A01958, "Base Final Testing"

For troubleshooting use, specification drawing A01946 has been included for testing at the PC Board Level.

Theory of Operation

3.1 Spirometer Circuit Description

3.2 Spirometer - Printer Circuit Description

3.3 Messages

3.1 Spirometer Circuit Description

The handheld spirometer's electronics are contained on two boards, designated the "Digital Board" and the "Analog Board". The analog board contains the power control circuitry, as well as the analog signal amplifiers. The digital board contains the digital circuitry, as well as the front panel components.

General

The spirometer is designed to minimize power consumption by having four separate operational states:

a. **OFF** When SW1 is off only the battery charge circuit is enabled. Only diode leakage current flows.

b. **ASLEEP** In this state SW1 is on and Vcc is present but the processor is not running. The switched analog power is off.

In this state:

i. CR1 is not oscillating
ii. RB is oscillating (100Khz)
iii. All port bits are tri-state except for P6 which has all bits low
iv. The data and address bus is passive
v. The RAM is disabled (U5 pin 26 is low)
vi. TP6 is low

Normally in this state, since the LCD controller is running, there will be something on the display. The software can, however, intentionally blank the display.

c. **AWAKE** In this state the digital circuitry is operating, but the analog power is off. This state is entered when the processor has some work to do.

In this state:

i. VA+ and VA- are not present
ii. U12 and U13 are not powered
iii. U8 is not operating
iv. CR1 is oscillating (8Mhz)
v. The CPU clock (pin 22 of U4) is running (2Mhz)

In normal operation this state will terminate and return to the sleep state as soon as the processor has nothing to do, such as while it is waiting for a keypress.

d. **FULL ON** In this state all of the circuitry is turned on. The charge pump may or may not be operating.

2. Power Consumption

If everything is correct the power consumption in the four states should be:

State 1: **OFF**: Less that 0.1ma, typ 0.001ma

State 2: **ASLEEP**: Less than 2.5ma, typ 1.6 ma

State 3: **AWAKE**: Less than 16ma, typ 10ma

State 4: **FULL ON**: Less than 35ma, typ 25ma

NOTE: That achieving these levels is both a hardware and a software function. Malfunctioning software can raise the power to as much as 5ma in State 2 and 70ma in State 4.

The maintenance mode of the spirometer allows it to be placed in each state for testing purposes.

3. Spirometer Power Circuit Description

The battery charge is supplied by U14 which is a voltage regulator wired as a 12ma current source. D6 and D7 provide reverse polarity protection.

Transistor T1 is the source for the current used in the spirometer if it is turned on while plugged into the printer. Its output voltage is regulated by the zener D13 to a voltage which will reverse bias D18 while at the same time insuring that the voltage reaching U8 does not exceed its design limit of 10v. This means that the tested voltage at TP1 must lie between 7.7 and 9.6v with 14-20v applied to the DC jack.

R22 and R23 divide the zener voltage to provide the sense voltage so that the processor can tell when DC is applied. This voltage should be between 4.20 and 4.85 volts with DC applied to the charging jack. This sense voltage is taken to pin 35 of the CPU and pin 1 of the U1.

The raw power for the spirometer comes from either the battery via D18, or if DC is supplied, via T1. It goes through the ON/OFF switch SW1 to the 5v regulator 119. U9 also supplies the low battery warning if Vcc comes out of regulation. This will occur when the battery voltage drops below about 6.3 volts.

Power for the analog sampling circuitry is taken directly from the battery so that it is impossible to test patients while powering the unit from the DC jack. T5 and T6 form a software controlled switch to turn analog power on only while actually needed and thus conserve battery power. This voltage will be on when CPU pin 2 is high. The voltage at the collector of T6 will be 6 to 10 volts when on, and can be easily tested at pin 1 or U1.

This switched analog voltage is inverted by U8, which should have a visible charge pump oscillating at eight kilohertz across C18. It will develop at least -6 volts across C20.

The switched analog voltage and its inversion are regulated by U7, T3, and T4 to provide +/- 4 volts VA+ and VA-. R18 and R19 divide Vcc to provide a guide voltage. U7A and T3 use this voltage to give VA+. U7B and T4 invert VA+ to provide a matching VA-.

TP2 and TP3 should measure +/- 3.90 to 4.10 volts. These voltages power the pressure transducer as well a U10 to U11.

The switched analog voltage is also, regulated by U15B and T2 to give an isolated 5v +/- 0.10 volts at TP6. This voltage powers the A/D and U12. Under the assumption that both devices will never be used at the same instant, this power is also used to supply U13 on units with a 610117-501 pressure transducers. Units with a 6010116-501 use Vcc.

Since the reference voltage from the A/D and the reference voltage of the transducer are both derived from Vcc, any variations in Vcc are ratiometrically canceled out.

U10 and U11 are powered by VA+ and VA- because they must deal with negative voltages. However, since VA+ is less than Vcc, they cannot swing the full voltage range of the A/D. Therefore, U15, the first amplifier stage, is powered by V+.

4. Spirometer Analog Circuit Description

When pressure sensing, VA+ and VA- must be on. The output of the transducer is a small differential signal (0.45 to 0.9 mv/cm H_2O) on a common mode signal of about -1 volts.

U10 forms a differential amplifier with adjustable gain. U11B removes the common mode voltage, provides an appropriate level shift, and provides a further gain of 5x. The output of U11B is frequency limited to a few hundred hertz by C25.

The bais voltage is supplied by a software charge pump. When appropriate software is running 0-1 Khz pulse train from pin 16 of the CPU charges C2 to 0-2 volts (TP4). U11A buffers this voltage and uses it to offset U11B.

The output of U11B (TP5) depends upon the particular transducer, the charge pump and the adjustment of R33 and R36. The nominal output is 0.125 volt with no pressure applied and 2.10 volts with a pressure corresponding to 12 L/S of airflow (approximately 6cm H_2O). With no pressure and no charge pump pulse train TP5 will be in the neighborhood of 1 volt.

U15A provides the final stage of amplification (2x). D9 clamps its input to prevent latch up when the output of U11B goes negative.

With VA on, the charge pump operating and R33 and R36 adjusted. U15A drives the A/D channel 0 with 0.5 - 4.5 volts as the airflow in the sensor ranges from 0 to 14 L/S.

5. Spirometer Digital Circuit Description

The CPU, U2, has an address and data bus which connects it to a 32K RAM U4, and 8K RAM, U5. Control for these is performed by U3.

D1 and C4 provide a power-on reset. Residual power is quickly discharged through SW1 and R3 to ensure that reset occurs every time the power is cycled.

The A/D, EEPROM and LCD controller (U6) are serial devices connected to the CPU ports.

The "**TEST**" key is connected directly to a CPU interrupt input. The other interrupt input is shared by the "**DATA**" key and the DC sense line from the power supply.

In order to allow both positive and negative transitions of DC input to cause interrupts. U1B can be used to invert the DC sense signal under software control. U1A forms a latch which can be forced high or low by software. R2 keeps it latched which can be forced high or low by the software. R2 keeps latched high or low when the CPU goes to sleep and the P4,4 goes to the tri-state condition.

6. Low Battery Detection

First, there is a signal from pin 5 of U9 which will go low if Vcc comes out of regulation. This will occur if the battery voltage falls below about 6.3 volts, depending on the load.

In normal operation Vcc coming out of regulation will be detected as soon as a key is pressed and the CPU wakes up again. No detection is made while the unit is waiting for a key press because the CPU is **ASLEEP**.

Another situation which can occur is that the battery is failing but Vcc has not yet come out of regulation. This condition is determined by software control of T7, which, when ON, couples VA+ into A/D converter channel 1. This allows VA+ to be compared to Vref = Vcc, from which it is possible to detect a failing battery.

This case is only detected when the spirometer enters the "**STEADY**" phase at the start of a test. This condition occurs when the battery voltage falls below about 6.2 volts.

Note that the latter form of low battery condition is "temporary", because when it is detected the "**LOW BAT**" warning is given and analog power is turned back off again. If Vcc is still good the "**LOW BAT**" message goes away again after several seconds and the unit returns to "**SELECT**".

A unit in this condition cannot perform further tests, but it can retain, review, and transmit an existing test.

Due to the sharp decay rate of NI-CAD batteries, this interim state will exist for only a short time. Before long, Vcc will come out of regulation and the "**LOW BAT**" condition will become permanent.

The operation of the low battery detection can be tested in maintenance mode by varying the voltage applied to the battery terminals while operating the unit.

3.2 Spirometer - Printer Circuit Description

1. Digital Circuit Desription

This board is based on the Mitsubishi 50734 processor which has an integral stepping motor driver, a UART and a four channel 8 bit A/D converter. This makes the digital circuitry very simple.

The printer mechanism has the thermal head driver internal to it, so the interface to the processor is simple and direct. The head temperature must be monitored by the processor so that the head pulse width can be controlled to produce a consistent end image at any temperature. In this circuit the head thermistor is balanced against an adjustable resistor which allows us to trim each unit for variations in the head and thermistor without trimming the timing constants within the software. The software is designed to prevent driving the head when the thermistor reading is out of range. By using other analog channels for "Head-up" and "Papersense" we avoid the need for logic level converters on these lines.

The printer mechanism prints 256 dots per line in four distinct banks of 64 dots. The signals DST1 through DST4 select the bank. The data for each bank is loaded serially from the processor using the **CLK**, **DIN**, and **LATCH** signals. The **ENABLE** signal protects the element heaters during CPU reset cycles.

In order to achieve maximum printing speed, the printing actually occurs while the paper is moving smoothly. Thus the printed horizontal lines are actually less diagonal.

The UDS 5707 serves to buffer the paper drive motor signals. D12 clamps the inductive surges. A port bit is used to disable the motor drivers when they are not being used. CPU pin 22 must be high to enable the motor. On newer boards this buffer is an SN 75437 (P/N 761181-501), and performs the same function.

The front panel is a simple matrix of switch closures isolated with doides. The options **DIP** switch is handled in the same way.

The two inverters connected to the CPU pin 23 functions as a latch which powers up in the low state but which can be forced to a latched high state by software. It is used to provide a reliable mechanism by which the software can distinguish between power-up reset and a reset caused by the front panel reset key.

The three inverters connected to CPU pin 20 provide enough drive to illuminate the front panel "ready" LED directly.

The alarm device is an electromagnetic transducer. It requires a transistor to drive it. D1 clamps inductive surges.

Communication with the spirometer is handled by protected direct UART connections. The signals are standard asynchronous ASCII at 4800 baud, however, the levels are CMOS logic levels, not RS232 level.

2. Printer Power Supply Circuit Description

The printer power supply provides 24 volts at 3 amps peak. 5 volts at 200ma, and 14 volts at 100ma.
The 24 volts output is regulated with a switching power regulator while the 5 and 14 volt supplies utilitize linear regulators. The present design incorporates a transformer that allows a primary voltage of either 90 to 132 vac or 200 to 275 vac.

The switching regulator IC has a maximum allowable supply voltage of 50 volts. The minimum output voltage for the 24 volt supply that will ensure proper printer operation and print contrast is 22 volts. Using a transformer with a nominal 25 volt secondary and a full wave bridge rectifier result in a voltage range of 27 volts to 43 volts at the regulator when the input voltage varies through the specified range.

The switching oscillator frequency is determined C17 and R32 which were selected to provide a 20Kh rate.

The 24 volt output is fed into a divider network made up of R27 and R28. The output of the divider network is then fed into the error amplifier, ERR1. The 5 volt reference voltage is reduced through a divider made up of R37, R38, and R39 to 2 volts, and also fed into ERR1. The difference voltage is then used to correct the 24 volt output voltage.

The output current is limited to 2.5A by comparing the voltage across R29 and to the 0.5 volt output of the reference divider network.

A soft start circuit made up of C18, R31, and R38 causes the regulator to wait about 50 clock cycles before the transistor control pulse width is increased to its normal duration.

3.3 Messages

The following is a tabulation of the various messages that may be displayed by the spirometer and/or printer by the printer:

Quality Messages

Indicates that this test has a greater FVC+FEV1 than the one currently in memory. It will replace the stored test.	**NEW BEST**
Indicates that this test is close to but not better than, the currently stored best test.	**MATCH**
Indicates that this test has a lower FVC or FEV1 by at least 5%, and will not replace the existing best test. To correct this, inhale more fully before blowing, and blast out harder at the start.	**NO MATCH**
The effort was good. (A "good" test is one with no identifiable faults.)	**GOOD FVC**
The patient coughed during the maneuver or flow was interrupted, or uneven. To correct this, the patient should refrain from coughing.	**COUGH**
5% or 0.1 liters of exhalation occurs before the back extrapolation point. (ATS specification.) To correct this the patient should blast out harder at the beginning of the maneuver.	**BAD. START**
The flow stopped abruptly. To correct this. The patient should keep blowing longer.	**BAD.STOP**
Low flow effort. To correct this, the patient should blast out harder.	**WEAK TRY**
The maneuver was less the 3 seconds long. To correct this, the patient should inhale more deeply and blow out longer. If this message is displayed during an MVV maneuver, the maneuver was less than 6 seconds long, and the patient should continue longer.	**TOO.SHORT**
The effort was good.	**GOOD MVV**

GOOD CAL

Each of the 3 calibration maneuvers was within 1/2% of the average. The existing calibration factor will be replaced with the cal factor from this calibration.

CF=XXX

Shows calibration value after a successful calibration was completed. The value is now the new calibration value replacing the old one that was previously stored in memory.

RETRY.CAL

One or more of the calibration maneuvers exceeded the average by more that 1/2%. The existing calibration factor is not updated.

Test Values

FVC x.xxx	In Liters
FEV1 x.xxx	In Liters
RATIO xx	% FEV1/FVC
MMEF x.xxx	In liters per second
PEF x.xxx	In liters per second
MVV xxx	In liters per minute
RATE xxx	In liters per minute
TIME xx.x	In seconds

Status Messages

CLEAR

Appears when the power is recycled, indicating that the memory is cleared.

TEST.MODE

Appears briefly when entering the test mode of the device.

SEND FVC

Indicates that the spirometer is transmitting an FVC test to the printer base.

SEND MVV

Indicates that the spirometer is transmitting an MVV test to the printer base.

Indicates that the device has begun charging the spirometer batteries.	**CHARGE**
Asks the operator or patient to hold the spirometer steady (with no movement) while it references the machine to zero flow in order to establish a baseline for future data.	**STEADY**
Indicates that the spirometer is in the process of readjusting the nominal charge pump value for zero flow.	**RETRIM**
Appears briefly while the spirometer calculating the results of a test.	**BUSY**
Appears when the operator pushes the **TEST** key from the ready position. If the operator does not push the **TEST** key again within 2 seconds, the spirometer will conclude that an MVV test is desired, and will begin the MVV sequence.	**FVC**
Appears if the operator presses the **TEST** key again within 2 seconds, the spirometer will conclude that an MVV test is desired, and will begin the MVV sequence.	**MVV**
Appears if the operator presses the **TEST** key immediately after the MVV message is displayed. Once this message is displayed, if the operator does not press the **TEST** key again within 2 seconds, the spirometer will conclude that a calibration is desired, and will begin the calibration sequence.	**CAL**
If the operator presses the **TEST** key immediately after the CAL message, the spirometer will go back to **READY**.	
Asks the patient to perform the nth FVC maneuver. Tests are numbered, so that you can see which test you are on.	**DO FVC n**
Asks the patient to perform the nth MVV maneuver.	**DO MVV n**
Asks the patient to perform the nth calibration maneuver.	**DO CAL n**

Exception Messages

FLOW LIM	The flow during a maneuver has exceeded the flow sensor's capacity of 14 liters/second (minimum).
VOL LIM	The volume during a maneuver has exceeded the spirometers capacity of liters (minimum).
TOO SOON	Flow was present as a sampling started.
TX FAIL	Transmission failure.
NO DATA A	Maneuver was interrupted, such as by the press of a key or the detection of a low battery.
NO DATA B	FVC or MVV timed out - the maneuver did not start within 13 seconds after the beep.
NO DATA C	FVC terminated normally, but on analysis, no exhalation was found.
NO DATA D	The FVC maneuver appeared too short and/or fragmented; possibly coughing with no blow.
NO DATA E	The MVV did not have enough breaths to analyze.
NO DATA F	During the MVV, the breaths were too inconsistent or uneven.
NO DATA G	Maneuver analysis routine failed: unable to analyze the data.

Problem and Error Messages

LOW BATT	The battery is too low to continue and requires recharging.
TEMP LIM	The temperature range of the spirometer has been exceeded. The acceptable operating range is between 59 and 105° F. The spirometer must be allowed to return to an acceptable temperature range before continuing.

The device cannot trim the baseline out. This is usually due to an abrupt thermal change. The machine must be allowed to return to an acceptable temperature range before proceeding.	**TRIM LIM**
Encountering either the **TEMP LIM** or **TRIM LIM** messages during normal operation may indicate a possible hardware failure.	
The spirometer failed to see a stable baseline value within 30 seconds.	**UNSTEADY**
Bus error.	**ERROR 0**
EEPROM check sum error. (This will occur once upon first use of a new machine).	**ERROR 1**
Out of memory.	**ERROR 2**
Opcode error--another form of bus error.	**ERROR 3**
Interrupt timing error.	**ERROR 4**
EEPROM failure.	**ERROR 5**
Spurious interrupt.	**ERROR 6**
Error numbers greater that these indicate an unexpected event in the program. In general, error messages are probably caused by a hardware failure.	

Troubleshooting

4.1 Technical Troubleshooting

4.2 Customer Service Questions and Answers

4.1 PneumoCheck Handle Technical Troubleshooting

Model Number: 61001

(Most frequent problems at top)

Complaint	Cause	Corrective Action
1. Reads unsteady	A) Defective transducer	A) Replace transducer
	B) Defective 766 regulator	B) Replace 766 regulator
	C) Broken transducer wire	C) Restore conections
2. Reads **'NO DATA B'**	A) Defective transducer	A) Replace transducer
	B) Broken transducer wire	B) Restore connections
3. Does not transmit (Tx fail)	A) Wrong side contact position	A) Reposition contacts.
	B) Dirty contacts	B) Clean contacts
	C) Broken wire in handle	C) Restore connections
4. Reads **'LOW BAT'**	A) Failed batteries	A) Test/replace batteries
	B) Corroded battery/contacts	B) Replace corroded items
	C) Defective component no voltage at TP 6	C) Replace U8, D18, or U12. Check for cold solder joints. Restore joints
5. Will not power up (energize)	A) Low battery voltage	A) Test/replace batteries
	B) Corroded battery contacts	B) Replace corroded items
	C) Dirty/corroded Pneumotach contacts	C) Clean dirty contacts. Replace corroded contacts
	D) Failed D18	D) Replace D18
	E) Failed On/Off Switch	E) Replace On/Off Switch
6. Reads error 5	A) Low battery voltage	A) Recharge battery. Replace defective battery
	B) Cold solder joint at J1 connector digital board	B) Restore solder joint
	C) Failed ribbon cable	C) Replace ribbon cable
	D) Cold solder joint on Processor	D) Restore solder joint on Processor
	E) Failed U12 ADC	E) Replace U12 ADC
7. Reads error 25	A) Old software	A) Upgrade to new software
	B) Failed temp. sensor	B) Replace temp. sensor
	C) High ambient temp.	C) Move to cooler room and cool unit down

PneumoCheck Handle Technical Troubleshooting

Model Number: 61001

Complaint	Cause	Corrective Action
8. Reads **'TEMP LIM'** (New software)	A) Failed temp. sensor	A) Replace temp. sensor
9. Reads error **'1'**	A) Failed U13 EPROM	A) Replace U13 EPROM
10. Reads error **35**	A) Failed prom	A) Replace programmed prom
11. Segments out	A) Old style On LCD	A) Replace digital PCB digital board
	B) Dirty LCD contact(s)	B) Clean LCD contact(s)
12. Reads **'RETRY CAL'**	A) Failed transducer	A) Replace transducer
	B) Failed Pneumotach	B) Replace pneumotach
	C) Loose mouthpiece hose	C) Tighten hose
13. Unstable on reading Will not calibrate	A) Noisy voltage (+4 and/or -4)	A) Check capacitors C12, C14, C15, C19, C20
	B) Failed capacitors or solder	B) Check restore connections
14. Fails recharge test	A) Unit not seated in printer	A) Remove and reseat handle
	B) Defective D18	B) Replace D18
	C) Defective D7	C) Replace D7
	D) Defective U14	D) Replace U14 LM317

PneumoCheck Printer Troubleshooting

Model(s): 76101

(Most frequent problems at top)

Problem	Cause	Corrective Action
1. Blown fuse	A) Line surge, open fuse(s)	A) Replace fuse(s)
	B) Shorted U7. Switching voltage regulator, 761099-1	B) Replace U7 regulator
	C) Shorted C17 capacitor (2.2 uf 50v)	C) Replace C17 capacitor
2. Does not advance paper	A) Failed print head motor section	A) Replace print head
	B) Defective J1 ribbon cable	B) Repair or replace J1
	C) Low +24v supply	C) Replace U7 and/or other associated failed part
	D) Failed U6 driver	D) Replace U6 driver
3. Will not power up (energize)	A) Open fuse(s)	A) Replace fuse(s)
	B) Failed U7 regulator	B) Replace U7 regulator
	C) Loose crimp on wire at P4 connector	C) Recrimp wire at P4
4. Bad or incomplete printout	A) Failed printhead PN 761085	A) Replace printhead
	B) Failed J2 ribbon cable	B) Replace J2 ribbon cable
	C) Cold V1 solder joint at processor	C) Repair solder joint
	D) Failed U1 processor	D) Replace U1 processor
5. No "Beep" signal on start up	A) Bad joint at U1, U3, U4	A) Repair cold solder joint
	B) Failed U5 prom 610102-506	B) Replace U5 prom
	C) Shorted print head	C) Replace print head
	D) Failed CR1 crystal	D) Replace CR1 crystal
6. Does not print proper age/ height format	A) Cold solder joint on rotary switch board	A) Repair solder joint
	B) Failed diode on rotary switch board	B) Replace failed diode
7. Does not print proper race/ sex format	A) Cold solder joint on control pcb	A) Repair solder joint
	B) Failed diode on control pcb	B) Replace failed diode
8. Does not print proper options format (sw1)	A) Cold solder joint at sw1 or associated diodes	A) Repair cold solder joint(s)
	B) Failed sw1 or associated diode	B) Replace sw1 or associated diode

4.2 Customer Service Questions and Answers

Reading On LCD

Solutions

Calibration

Make sure they are not attempting to calibrate while the handle is in the printer well.

Make sure they realize there is a **CALIBRATION CHECK** and a **RECALIBRATION.** When performing calibration, 3 liter syringe must be operated smoothly and evenly with consistent speed. Refer to pages 32, 33, 34, & 35 of operating instructions for the calibration instruction.

The American Thoracic Society recommends checking accurancy of calibration daily.

If documentation of the calibration check is required, insert the handle in the printer well and push print after a cal check had been completed. (Note: They cannot get a printout of the recalibration).

Cleaning & Sterilizing

The pneumotach screen should be inspected daily and cleaned when necessary.

We recommend cleaning and sterilizing the pneumotach assembly every 50 maneuvers. They can be steam autoclaved, ethylene oxide, soaked or boiled.

Regardless of sterilization method, pneumotach must be completely dry before reusing. A wet or damp pneumotach inaccurate results. Four days air drying time is required, or 10 minutes with a hair dryer on high.

Display Blank (Or Fading)

Handle must come back for repair.

Erroneous Results

The handle must come back for checking and repair.

Error 5

Turn the unit off, then on again. It may reset itself. If not, it is a hadware problem-handle must come back for service.

Error 23	Infrequently customer complains of Error 23. Have them turn handle off/on to see if it will reset-perhaps leave for a couple minutes and try again. In talking the Tech. Rep., they have not been able to duplicate problem inhouse. Customer must return both handle and printer for service.
Error 25 Or Temp. Lim	This is a temperature problem. Is the office extra warm (cold) today? Is the unit sitting in direct sun, near heat register, etc.? Advise to put the handle on the desk for a minute before attempting a test - it should be OK. If the error message continues and creates a problem they may return handle for new software update (3.5) It was also discovered Error 25 could indicate low battery. Change batteries.
Forced Vital Capacity	The amount of air that can be exhaled during a rapid forced exhalation. (1 long, hard blast)
Getting the Wrong Graph	Have them check the bottom of the printer, “flip” the 4th switch the opposite way, and see it that corrects the situation.
Green Data Light on Printer	This indicator light will be lit as long as there is information on the printer. If they want to clear the printer entirely, it must be unplugged. If the customer has entered incorrect data in the height or age, and the patient data is still in the printer, all they need to do is insert correct info and push print.

Low Batt Message

Are batteries within warranty? Check battery voltage should be 3.5 volts.

Are the printer & handle power lights (orange) on? Put in charger overnight, try again. Has it been in the printer charger?

If error 5 appears after unit has been in printer for more than 3 hours, let unit cool down. If error 5 goes away, there is a hardware failure, unit must be returned.

Make sure the contacts in the pneumocheck assembly are making good contact with the batteries. Clean contacts.

If necessary, return handle & printer for checking.

Maximum Voluntary Ventilation

The largest column of air inhaled and/or exhaled over a timed period. This maneuver imitates rapid breathing.

No DATA B

The maneuver did not start within 20 seconds after the "beep".

Have them try again, watching the display carefully. If a problem, return handle.

No % Or Norms on Printout

The problem is due to the information the user entered into the printer:

Page 54 in Operating Instructions

The **AGE** of the individual is outside the limits built into the predicted values (for Knudson 3, the limits are age 5 to 83 for males and 87 for females). These can be found on Pages 54 through 58 of the operating instructions. Pages 52 & 53 of the operating instructions gives the formula for calculating predicted values manually.

Or the **HEIGHT**is entered wrong. You can use either inches or centimeters, and in using inches the "O" must go in the first space. Example: Patient is 5 foot 6 inches tall. Info entered into machine: 066

No % Or Norms on Printout

Page 54 in Operating Instructions cont'd

Pneumocheck handle is in test mode-you will received no % norms in the print-Turn on w/out buttons depressed. Remove handle-turn unit off turn handle on into normal mode.

No Power to Printer

They may have blown a fuse.

No Print on Printout

Make sure the paper is inserted correctly.

If cannot be corrected, printer must be returned for service.

Paper Replacement

Remove printer cover.

Feed any remaining paper through printer. **DO NOT PULL PAPER BACKWARDS THROUGH THE PRINGER.**

Save black plastic spindle.

Put red lever all the way forward.

Place new roll of paper in the printer well. The paper feeds forward from the bottom of the roll.

Insert edge of paper under the gray rubber pinch roller until paper exits top of printer.

Push red lever as far back as possible.

Press **FEED** button to feed paper through.

Replace printer cover.

The printer does not store more than one patients Data

The printer saves only the best test.

If the doctor wants a printout of all the tests on a patient, they have to run a test, print it out, then turn off the Pneumocheck and start over again as a new test.

THE PNEUMOCHECK HANDLE SHOULD BE LEFT IN THE OFF POSITION TO KEEP THE BATTERY FULLY CHARGED AT ALL TIMES. THE PRINTER SHOULD BE LEFT PLUGGED IN.

Printer Options

On the bottom right hand corner of the printer, there are 4 little dip switches.

1 & 2 control the predicted
3 indicates long or short form
4 indicates volume/time or flow/volume graph.

Refer to page 24 of operating instructions.

When the machines leave the factory, they are set with all the switches in the off position, i.e., they are set for the Knudson 83 predicted values, short form, and flow/volume graph.

The norms that are selected, together with the version of software in the machine print out on each tape. This is located just below the actual values.

Example: **NORMS: KNUDSON 1983 (VS35P31)**
(The "S" means handle, "P" means printer)

Retrim

The message "Retrim" in itself is no problem. They **MUST** let the unit work thru this step. If they turn it off, they will only get retrim the next time they go to do a test. The retrim mode lasts 45 seconds to 1 minute, then it will advance to "do FVC". (Sometimes I have found it necessary to have the customer get the instrument into "retrim" mode and time with a watch. It may seem like an eternity, but actually will be within the 1 minute range).

Retrim only means the instrument is trying to establish the baseline. It will not go into this mode each time they want to do a procedure.

If retrim occurs regularly, or if it will not advance after the 1 minute, handle must be returned for service.

Standards Compliance

The Welch Allyn PnuemoCheck complies with
American Thoracic Society
OSHA
UL
CSA
IEC

Trim.Lim	Handle cannot trim the baseline. May be due to an abrupt thermal change or weak battery. If not, may be hardware failure. If so, turn handle off/on. If unit does not clear, return for service.
TX Fail (Transmission Fails)	Broken or bent contact in handle or printer? Push paper feed button - Does paper feed through machine. If not: Is there paper in the machine? Is paper tension lever (red, near paper roll) pushed back all the way? Make sure that paper is properly fed. There could be a paper jam. To clear: Depress STOP & FEED buttons simultaniously. Release STOP button. This will feed paper backwards. Release FEED button. This should clear the jam. Depress FEED button - paper should flow through OK. **Printer does not advance paper and/or unit grinds or strains when the feed button is depressed.** As a "last ditch" effort, unplug the printer ar the back and plug it in again - this should reset the machine.
Unsteady	While in the "steady" mode, was the handle moved? If not, problem could be a bad tranducer - handle must be returned for repair.

Disassembly and Repair

5.1 Pneumocheck Handle

5.2 Pneumocheck Printer/Charger

5.1 PNEUMOCHECK HANDLE DISASSEMBLY PROCEDURES

ITEM NUMBERS REFERENCED ON DRAWING 610135 (SPIROMETER ASSEMBLY)

This section describes how to remove the following subassemblies and major components:

A. **MOUTH PIECE ASSEMBLY** (Item 3)
B. **PNEUMOTACH ASSEMBLY** (Item 18)
C. **REAR BASE ASSEMBLY** (Item 2)
D. **ELECTRONIC COMPONENT ASSEMBLY** (Item 6)
E. **FRONT HOUSING ASSEMBLY** (Item 21)
F. **BATTERY CONTACTS** (P/N 610067)
G. **PRESSURE TRANSDUCER ASSEMBLY** (P/N 610116-502)

NOTE: All work must be done at a grounded work station by grounded personnel.

A. Removing the **MOUTH PIECE ASSEMBLY** (Item 3)

1. Remove the **MOUTH PIECE ASSEMBLY** by pulling it straight off the **PNEUMOTACH ASSEMBLY** (Item 18).

Reassembly is the reverse of disassembly.

B. Removing the **PNEUMOTACH ASSEMBLY** (Item 18)

1. Loosen the two studs (item 19) at the bottom of the body with a coin or screwdriver.

2. Remove the **PNEUMOTACH ASSEMBLY**.

NOTE: The **MOUTH PIECE ASSEMBLY** (item 3) is not part of the **PNEUMOTACH ASSEMBLY**. The **MOUTH PIECE ASSEMBLY** may be removed as instructed in Part A.

Reassembly is the reverse of disassembly.

NOTE: Torque the studs (item 19) to 5 - 8 in. lbs.

C. Removing the **REAR BASE ASSEMBLY** (item 2)

1. Remove the **PNEUMOTACH ASSEMBLY** (item 18) as instructed in Part B.

2. Remove the two pressure port gaskets (item 11), the two retaining rings (item 14), and the compression ring (item 12).

3. Peel off the **LABEL** (item 1) affixed to the **REAR BASE ASSEMBLY** (item 2).

NOTE: This label must be removed to reveal two screws holding the **REAR BASE ASSEMBLY** to the rest of the assembly. Once this label is removed it cannot be reused. Always affix a new label after repair.

4. Remove the two screws (item 10) from the **REAR BASE ASSEMBLY**.

5. Remove the REAR BASE ASSEMBLY.

NOTE: The **BATTERY HOLDER** (item 15) is not part of the **REAR BASE ASSEMBLY**. If the **REAR BASE ASSEMBLY** is being replaced, use the old **BATTERY COMPARTMENT** (if reusable) with the new **REAR BASE ASSEMBLY**.

Reassembly is the reverse of disassembly.

Torque item 17 to 5 - 6.25 in. lbs.
Torque item 10 to 5.8 - 7.25 in. lbs.

D. Removing the **ELECTRONIC COMPONENT ASSEMBLY** (item 6)

NOTE: The **ELECTRONIC COMPONENT ASSEMBLY** consists of two P.C. boards (see parts drawing), the analog assembly and the digital assembly. These P.C. boards are a matched set, and must always be replaced as a matched set.

1. Remove the **PNEUMOTACH ASSEMBLY** (item 18) as instructed in Part B.

2. Remove the **REAR BASE ASSEMBLY** (item 2) as instructed in Part C, Steps 2 - 5.

3 **Note the routing of the rubber hose. The rubber hose must be routed the same way during reassembly with no kinks or pinches.**

4. Remove the two screws (item 5) securing the analog assembly to the standoffs (item 7).

5. Slide the charging contacts (which are wired to the analog assembly) out of their slots in the **FRONT HOUSING ASSEMBLY** (item 21).

6. Remove the four standoffs (item 7) and the single screw (item 20) that secure the digital assembly to the **FRONT HOUSING ASSEMBLY** (item 21).

7. Remove the two stud assemblies (items 9 and 22) and the top and bottom insulating paper (items 8 and 9 respectively).

NOTE: If a new stud assembly is needed, make one by assembling item 22 onto item 19 and tightening 18 - 20 in. lbs.

8. Remove the **ELECTRONIC COMPONENT ASSEMBLY**.

NOTES:
Torque items 20 and 7 to 5 - 6.25 in. lbs.
Torque item 5 to 1.1 to 1.3 in. lbs.

Reassembly is the reverse of disassembly.

E. Removing the **FRONT HOUSING ASSEMBLY** (item 21)

1. Remove the **PNEUMOTACH ASSEMBLY** (item 18) as instructed in Part B.

2. Remove the **REAR BASE ASSEMBLY** (item 2) as instructed in Step C, Steps 1 - 5.

3. Remove the **ELECTRONIC COMPONENT ASSEMBLY** (item 18) as instructed in Part D.

4. Remove the **FRONT HOUSING ASSEMBLY**.

NOTE: If the **FRONT HOUSING ASSEMBLY** is being replaced, copy the serial number from the old assembly onto the blank label of the new assembly.

Reassembly is the reverse of disassembly.

F. Removing the **BATTERY CONTACTS** (P/N 610067)

NOTE: These instructions apply only to assemblies where the **BATTERY CONTACTS** are glued to the P. C. Board. Also, anytime old **BATTERY CONTACTS** are removed, the new **BATTERY CONTACTS** must be soldered onto the P. C. Board.

1. Remove the **PNEUMOTACH ASSEMBLY** (item 18) instructed in Part B.

2. Remove the **REAR BASE ASSEMBLY** (item 2) as instructed in Part C, Steps 2 - 5.

3. Remove the **ELECTRONIC COMPONENT ASSEMBLY** (item 6) as instructed in Part D, Steps 3 - 8.

4. Remove the 0-80 X .187 screw (P/N 106100-10), the 0-80 hex nut (P/N 106109-1) and the flat washer, (P/N 106103-3) holding the battery contact to the analog P. C. Board.

5. Remove the **BATTERY CONTACT.**

Reassembly is the reverse of disassembly

NOTE: Remove residual epoxy and clean the **BATTERY CONTACTS** and the P. C. Board pads with a degreaser before assembly.

Solder the new **BATTERY CONTACTS** (P/N 610067-1) onto the P. C. Board.

Torque to bolts to 13 - 16 in. oz.

G. Removing the **PRESSURE TRANSDUCER ASSEMBLY** (P/N 610116-502).

1. Remove the **PNEUMOTACH ASSEMBLY** (item 18) as instructed in Part B.

2. Remove the **REAR BASE ASSEMBLY** (item 2) as instructed in Part C, Steps 2 - 5.

3. Remove the **ELECTRONIC COMPONENT ASSEMBLY** (item 6) as instructed in Part D, Steps 3 - 8.

4. Remove the solder and the **PRESSURE TRANSDUCER ASSEMBLY** from the P. C. Board

Reassembly is the reverse of disassembly

NOTE: See drawing No 610051 for a view of how to resolder a **PRESSURE TRANSDUCER ASSEMBLY** to the P. C. Board.

5.2 PNEUMOCHECK PRINTER/CHARGER DISASSEMBLY PROCEDURES

ITEM NUMBERS REFERENCED ON DRAWING 761168 (DOMESTIC EXPLODED VIEW MODEL 76101)

ITEM NUMBERS REFERENCED ON DRAWING 761170 (INTERNATIONAL EXPLODED VIEW 220V MODELS 76102, 76104, 76106)

These procedures describe how to remove the following subassemblies and major components:

A. **TOP PANEL ASSEMBLY** (Item 1)

B. **CONTROL P. C. BOARD ASSEMBLY** (Item 10)

C. **SPRING CONTACTS** (Item 13)

D. **MAIN P.C. BOARD ASSEMBLY** (Item 14)

E. **THERMAL PRINTER** (Item 11)

F. **TRANSFORMER ASSEMBLY** (Item 8)

G. **RFI FILTER** (Item 7)

H. **FUSES** (Item 29)

I. **BASE HOUSING ASSEMBLY** (Item 19)

J. **ROTARY SWITCH ASSEMBLY** (Item 38)

Before doing any work:

1. All work must be done at grounded work stations by grounded personnel.

2. Remove the **PRINTER COVER**.

3. Reverse feed the paper out of the **THERMAL PRINTER** (item 11) by pressing the **STOP** button, pressing the **FEED** button, and then releasing the **STOP** button (in that order).

4. Remove the AC line cord from the AC outlet and from the back of the **PRINTER/ CHARGER**.

5. Remove the **PAPER ROLL** (item 4) and the **SPINDLE** (item 5).

6. Refer to the parts drawing when following procedures. There are two drawings for this purpose: one for U.S.A. and Japan., and one for the U.K. Australia, and Europe.

A. Removing the **TOP PANEL ASSEMBLY** (Item 1)

1. Remove the seven phillips drive screws (6-item 18 and 1-item 19), securing the **TOP PANEL ASSEMBLY** to the **BASE HOUSING ASSEMBLY** (item 17).

2. Carefully lift the **TOP PANEL ASSEMBLY** high enough so that the flat ribbon cable can be reached and unplug it from the **CONTROL P.C. BOARD ASSEMBLY** (item 10).

NOTE: Be careful not to damage the **SPRING CONTACTS** (item 13) when lifting the **TOP PANEL ASSEMBLY.**

3. Unplug the remaining flat ribbon cable connector for the **TOP PANEL ASSEMBLY.**

4. Remove the **TOP PANEL ASSEMBLY**.

Reassembly is the reverse of disassembly.

NOTES: The ribbon cable is plugged in properly when the **RED** wire of the connector to the **CONTROL P. C. BOARD ASSEMBLY** (item 10) is to the LEFT when facing the front of the **PRINTER/ CHARGER**.

The **RED** wire of the connector to the rotary board (part of the **TOP PANEL ASSEMBLY**) should be to the **RIGHT**.

Torque (items 18 and 19) to 3 - 4 in. lbs.
Torque (item 2) to 2.7 - 3 - 4 in. lbs.

B. Removing the **CONTROL P. C. BOARD ASSEMBLY** (item 10)

1. Remove the **TOP PANEL ASSEMBLY** (item 1) as instructed in Part A.
2. Remove the three screws (item 26) that hold the **CONTROL P .C. BOARD ASSEMBLY**.
3. Remove the CONTROL P.C. BOARD ASSEMBLY.

Reassembly is the reverse of disassembly.

NOTE: Torque (item 26) to 1.0 - 1.5 in. lbs.

C. Removing the **SPRING CONTACTS** (item 13)

1. Remove the **TOP PANEL ASSEMBLY** (item 1) as instructed in Part A.
2. Remove the screws (items 12) securing the **SPRING CONTACTS** to the **MAIN P.C. BOARD ASSEMBLY** (item 14).
3. Remove the **SPRING CONTACTS**.

Reassembly is the reverse of disassembly.

Torque item 12 to 1.5 - 2.0 in.lbs.

NOTE: If original contact springs are damaged replace with:

1 Spring contact P/N 761009
1 Contact block P/N 761010

Use 3/32" hex key to tighten 4-40 x 1 SHCS P/ N 106119-6 (4 required)

D. Removing the **MAIN P.C. BOARD ASSEMBLY** (item 14)

1. Remove the **TOP PANEL ASSEMBLY** (item 1) as instructed in Part A.

2. Remove the two bolts (made of item 18, 21, and 22) securing the **MAIN P.C. BOARD ASSEMBLY** to the **BASE HOUSING ASSEMBLY** (item 17).

3. Lift the **MAIN P.C. BOARD ASSEMBLY** high enough to unplug the connector from the **TRANSFORMER ASSEMBLY** (item 8) going to the bottom of the board.

4. Remove the **MAIN P.C. BOARD ASSEMBLY**.

NOTE: Torque the bolts (items 18, 21, and 22) to 3 - 4 in. lbs.

E. Removing the **THERMAL PRINTER** (Item 11)

1. Remove the **TOP PANEL ASSEMBLY** (item 1) as instructed in Part A.

2. Remove the **MAIN P.C. BOARD ASSEMBLY** (item 14) as instructed in Part D, Steps 2 - 4

3. Remove the three nuts and washers (items 2 and 23) securing the **THERMAL PRINTER** and the **PRINTER WELL** (item 6) to the **MAIN P.C. BOARD ASSEMBLY** (item 14).

4. Remove the nut and washer (items 21 and 22) securing the **GEAR COVER** (item 3) and the **PRINTER WELL** (item 6) to the **MAIN P.C. BOARD ASSEMBLY** (item 14).

5. Disconnect the two plugs connecting to the **THERMAL PRINTER.**

NOTE: The longer of the two plugs should be connected such that no pin from the printer is inserted in the far right socket of the plug. (This is an extra socket on the plug and is not used).

6. Remove the **THERMAL PRINTER** and the **PRINTER WELL**.

NOTES: The **THERMAL PRINTER** may be pulled from the side of the **PRINTER WELL** (item 6).

If the **PRINTER WELL** is being replaced, remove the **GEAR COVER** (item 3) and its securing nut and washer (item 21 and 23) from the **PRINTER WELL**. Use the old **GEAR COVER** (if reusable) on the new **PRINTER WELL**.

If the **GEAR COVER** (item 3) is being replaced, copy the serial number off the old **GEAR COVER** onto the blank label of the new one.

Reassembly is the reverse of disassembly.

NOTE: Torque (item 21) to 3 - 4 in. lbs.

F. Removing the **TRANSFORMER ASSEMBLY** (item 8)

1. Remove the **TOP PANEL ASSEMBLY** (item 1) as instructed in Part A.

2. Remove the **MAIN P.C. BOARD ASSEMBLY** (item 14) as instructed in Part D, Steps 2-4

3. Unplug the **BROWN, BLUE,** and **GREEN/YELLOW** wires from the **RFI FILTER** (item 7)

4. Remove the bolt (items 19, 21, and 22) securing the fuse plate to the **BASE HOUSING ASSEMBLY** (item 17).

5. Remove the bolt (items 20, 23, and 24) securing the transformer nearest to the front of the **PRINTER/CHARGER.**

NOTE: Refer to the parts drawing when reassembling, be sure to use this bolt in the same position (item 80 is 0.630 inches long, and this bolt uses two pieces of items 23 and 24).

6. Remove the bolt (items 27, 23, and 24) securing the transformer nearest to the rear of the **PRINTER CHARGER.**

NOTE: Refer to the parts drawing when reassembling, be sure to use this bolt in the same position (item 27 is 0.437 inches long).

7. Remove the **TRANSFORMER ASSEMBLY.**

Reassembly is the reverse of disassembly.

NOTE: Torque both bolts (items 20 or 27, 22, and 24) to 8 - 10 in lbs.

Refer to the parts drawing for correct position of the **BROWN** and **BLUE** wires.

G. Removing the **RFI FILTER** (item 7)

1. Remove the **TOP PANEL ASSEMBLY** (item 1) as instructed in Part A.

2. Remove the **MAIN P.C. BOARD ASSEMBLY** (item 14) as instructed in Part D, Steps 2 - 4.

3. Unplug the **BROWN, BLUE** and **GREEN /YELLOW** wires from the **RFI FILTER** to the **BASE HOUSING ASSEMBLY** (item 17).

4. Remove the two bolts (items 18, 21, and 22) securing the **RFI FILTER** to the **BASE HOUSING ASSEMBLY** (item 17).

5. Remove the **RFI FILTER**.

Reassembly is the reverse of disassembly.

NOTE: Torque the bolts (item 18, 21, and 22) to 3 - 4 in. lbs.

Refer to the parts drawing for the correct position of the **BROWN, BLUE** and **GREEN/YELLOW** wires.

H. Replacing a **FUSE** (item 29)

1. Remove the **TOP PANEL ASSEMBLY** (item 1) as instructed in Part A.

2. Remove the remaining bolts (items 19, 21, and 22) securing the fuseplate (part of item 8) of the **BASE HOUSING ASSEMBLY** (item 17).

3. Lift the fuseplate and replace the blown fuse(s). Replace fuses only with part number 761084-1 (U.S.A./Japan) or 761084-3 (U.K.,Europe, Australia).

Reassembly is the reverse of disassembly.

NOTE: Torque the bolt (item 19, 21, and 22) to 3 - 4 in. lbs.

I. Removing the **BASE HOUSING ASSEMBLY** (item 17)

1. Remove the **TOP PANEL ASSEMBLY** (item 1) as instructed in Part A.
2. Remove the **MAIN P.C. BOARD ASSEMBLY** (item 14) as instructed in Part D, Steps 2 - 4.
3. Remove the **TRANSFORMER ASSEMBLY** (item 8) as instructed in Part F, Steps 3 - 7.
4. Remove the **RFI FILTER** (item 7) as instructed in Part G, Steps 4 -5.
5. Remove the **BASE HOUSING ASSEMBLY**.

Reassembly is the reverse of disassembly.

J. Removing the **ROTARY SWITCH ASSEMBLY** (item 38).

1. Remove the **TOP PANEL ASSEMBLY** (item 1) as instructed in Part A.
2. Peel off the **PRINTER/CHARGER ESD LABEL** (item 37). Be sure to remove all the adhesive from the **TOP PANEL ASSEMBLY** (item 1).
3. Remove **ROTARY SWITCH ASSEMBLY**.

Reassembly is the reverse of disassembly.

NOTE: Always use a new **ESD LABEL** (item 37).

Pneumocheck Handle and Printer/Charger Spare Parts

Part Number	Description
610015-503	Housing Body Rear
610064-501	Mouthpiece
610067	Battery Contact
610071	Pneumotach Contact
610028	Pressure Port Gasket
610031	Mouthpiece Gasket
61030	3.0 Liter Calibration Syringe and Hose
61050	Pneumotach Assembly
610002	Accessory Box
610116-502	Pressure Transducer
610138-501	Front Housing
610157-501	Pneumotach Body
761013-501	Cover Cutter Assembly
761021-507	Printer P C Board
761050-1	Spindle
761070	Rubber Foot
761076-0	Power Cord
761009	Spring Contact
761010	Contact Block
106119-6	4-40 x 1.00 Screw
761049	Label
761056	Label
761059-2	Label
761084-1	Fuse
761085	Printer Head
761099-1	Voltage Regulator
761117	Paper Roll
761141	Label
761150	Label
761159-501	Rotary Switch Board
72500	Two 3.6V Rechargeable Batteries (7.2V), Replacement

List of Drawings and A Specs

ASpec/Drawing	Description
A00167	Dielectric Strength Test for UI/CSA Equipment
A00171	Leakage Current Test for Manufacture of Non-Patient Connected Equip.
A00172	Grounding Continuity Test W/ Non-Detachable Power Cord
A00178	Dielectric Strength Test for IEC Equipment
A01943	Spirometer Board Level Testing
A01945	Calibrating the Welch Allyn Spirometer
A01946	Printer Board Level Testing
A01951	Dynamic Waveform Testing
A01958	Printer Base Final Test
A02242	Grounding Continuity Test W/ Detachable Power Cord
610041	Digital PCB Assembly
610051	Analog PCB Assembly
610135	Spirometer Assembly
610142	Schematic, Spirometer, Analog Board
610143	Schematic, Spirometer, Digital Board
761021	Main PCB Assy - Printer
761143	Schematic, Spirometer Printer Board
761168	Domestic Exploded View Model 76101
761170	International Exploded View 220V Models 76102, 76104, 76106

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REV	REVISION DESCRIPTION	ECN	INIT	DATE	APPROVAL
A	A00167 WAS 26500019		DE	5-19-81	
B	REMOVED STEPS 2 & 3	18742	RBB	3-10-89	565/RMD

AT THE CONCLUSION OF MANUFACTURE AND BEFORE SHIPMENT, EACH UNIT SHALL BE SUBJECTED TO THE FOLLOWING DIELECTRIC STRENGTH TEST. THE TEST SHALL BE MADE BY APPLYING FOR ONE MINUTE (20% HIGHER FOR ONE SECOND) WITHOUT BREAKDOWN*, A 60Hz POTENTIAL (RMS) AS FOLLOWS:

1. BETWEEN PRIMARY WIRING (BOTH SIDES OF SUPPLY TERMINALS CONNECTED TOGETHER) AND ACCESSIBLE DEAD METAL PARTS (NON-CURRENT CARRYING CONDUCTIVE PARTS) 1000 VAC (1200 VAC FOR 1 SECOND).
   REF: UL 544 PAR. 42.1, 42.2, TABLE 42.1 AND UL FILE E15508, VOL. 1, APP. D, PAGE 4, ISSUED 3/2/77.
   THE CSA TEST VOLTAGE OF 1000 VAC (1200 VAC FOR 1 SECOND) REF: C22.2 #125, 6.7.2, a, ii IS ENCOMPASSED IN THE ABOVE TEST.

*BREAKDOWN WILL NORMALLY BE INDICATED BY TRIPPING OF A SUITABLE OVERLOAD PROTECTOR IN THE TEST EQUIPMENT, BUT AN ABRUPT DECREASE OR RETARDED ADVANCE OF THE VOLTMETER READING COULD ALSO BE INDICATIVE OF INSULATION FAILURE. REF: UL 544, PAR. 31.3. A BREAKDOWN IS ALSO CONSIDERED TO HAVE OCCURRED IF AFTER THE TEST THE EQUIPMENT DOES NOT COMPLY WITH RISK CURRENT TEST EVEN THOUGH THERE IS NO ARCING, TRACKING, OR OTHER EVIDENCE OF A BREAKDOWN.
REF: CSA 22.2 #125, 6.7.3 NOTE 5.

MATERIAL:	FINISH:	QTY 504	QTY 503	QTY 502	QTY 501	ITEM OR SYMBOL	PART NUMBER	DESCRIPTION
								LIST OF MATERIAL

REF. DWGS

UNLESS OTHERWISE SPECIFIED:
METRIC DIMENSION (WHEN USED) ARE IN ( ).
DIMENSIONS INCLUDE PLATING.
REMOVE BURRS & SHARP EDGES
THREADS ARE UNIFIED SERIES AND INCLUDE PLATING:
EXTERNAL THDS - CLASS 2 A

GROUP	NEXT ASS'Y	QTY	USED ON
			711300

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCES ON:

BASIC DIMENSION	XX	XXX
UP TO 6	± .02	± .005
ABOVE 6 TO 24	± .03	± .010
ABOVE 24	± .06	± .015

ANGLES: ± ½ DEGREE

		DATE
DRAWN	R. UHL	3-28-77
CHECKED	D Danna	4-5-77
APPROVED	R Uhl	5/13/77
REL. FOR PROD		

WELCH ALLYN, INC.
SKANEATELES FALLS, N.Y. U.S.A.

TITLE: DIELECTRIC STRENGTH TEST FOR MANUFACTURING OF NON-PATIENT CONNECTED EQUIPMENT.

CODE IDENT.		DRAWING NO		REV
64475	B	A00167	Ⓐ	B

B A00167 Ⓐ B

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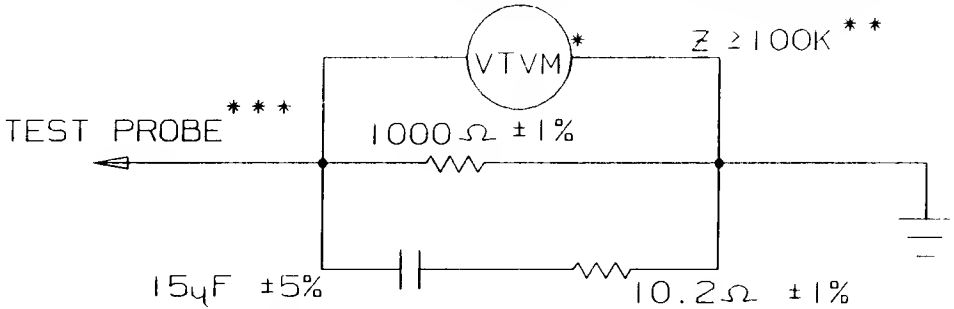
REV	DESCRIPTION	ECN	INIT	DATE	APPR
B	REDRAWN ON CAD, ADDED LESS THAN	S-29691	SB	1-5-95	

THE FOLLOWING CIRCUIT IS TO BE USED FOR THE MEASURING OF LEAKAGE CURRENT:

(REF: CSA C22.2 #125, FIGURE 8, 9, PAGE 46 AND UL 544, PAR 27.5)



* THE METER IS TO BE AVERAGE-RESPONDING & INDICATE RMS VALUE OF A PURE SINE WAVE WITHIN AN OVERALL MEASURING CIRCUIT ERROR OF NOT MORE THAN 5 PERCENT AT INDICATIONS OF 10, 50, 100 AND 500 MICROAMPERES (10, 50, 100 AND 500 MILLIVOLTS, RESPECTIVELY, WHEN USING A 1000 OHM RESISTOR) AT FREQUENCIES FROM 10 Hz TO 100 Hz. (REF UUL 544, PAR 27.13 B, CSA C22.2 #125 PAR 6.3.2.2.6 IV).

** REF: CSA C22.2 #125 PAR 6.2.2.2b, i.

*** ...THE RESISTOR AND METER ARE TO BE CONNECTED BETWEEN THE ACCESSIBLE PARTS AND THE GROUNDED SUPPLY CONDUCTOR (REF: UL 544, PAR 27.13 C).

(B) THE LEAKAGE CURENT MEASURED FROM ANY EXPOSED METAL PARTS TO GROUND WITH AN INPUT VOLTAGE OF 120V, 60 Hz OR (240V, 50 Hz) ANF THE GROUND WIRES SECURELY CONNECTED SHALL BE LESS THAN 50 MICROAMPS (EQUIVALENT TO 47.5 MV IN THE ABOVE CIRCUIT).

REF. CSA C22.2 #125, TABLE 8
UL 544 TABLE 27.1

SUPERSEDES DWG DATED 4-5-77

MATERIAL.	PART NO	DESCRIPTION	
FINISH.	DRAWN S BUERKLE R UHL — DATE 1-5-95 4-5-77	Welch Allyn SKANEATELES FALLS, NEW YORK U.S.A.	
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES AND INCLUDE PLATING -TOLERANCES- .XX = ±.02 ANGLES: ±1/2° .XXX = ±.005 TOLERANCES PER ANSI Y14.5 REMOVE BURRS & SHARP EDGES EXTERNAL THDS = CLASS - 2A INTERNAL THDS = CLASS - 2B	DESIGNED	TITLE: LEAKAGE CURRENT TEST FOR MANUFACTURE OF NON-PATIENT CONNECTED EQUIPMENT	
	CHECKED D DANNA — 4-5-77		
	APPROVED R UHL — 5-13-77	CODE IDENT 64475 — B	DRAWING NO. A00171 — REV B
	REL TO PROD JC JR — 6-20-77	SCALE NONE — DO NOT SCALE	SHEET 1 OF 1

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REV	REVISION DESCRIPTION	ECN	INIT	DATE	APPROVAL
B	REDRAWN ON CAD & ADD'D TO REF NOTE.	S-20148	SB	12-27-89	BAC
C	C:(SECOND EDITION) WAS F:	S-21835	RJG	10/3/90	PL
D	CHANGE REF. FROM PAR C TO PAR F	S-22081	CCS	11-5-90	PL
E	REVISE TITTLE, SEE ECN	S-23316	CCS	12/7/91	

TITLE: GROUNDING CONTINUITY TEST FOR PATIENT-CONNECTED AND NON-PATIENT CONNECTED EQUIPMENT WITH NON-DETACHABLE POWER CORD. (E)

AT THE CONCLUSION OF MANUFACTURING AND BEFORE SHIPMENT, EACH UNIT SHALL BE SUBJECTED TO THE FOLLOWING GROUNDING CONTINUTITY TEST:

(E) THE RESISTANCE BETWEEN THE GROUNDING PIN OF THE ATTACHMENT PLUG AND ANY ACCESSIBLE METAL PART OF THE APPLIANCE SHALL NOT EXCEED 0.2 OHM. TEST WILL BE CONDUCTED USING A 10 AMP CURRENT SOURCE WITH A NO-LOAD VOLTAGE NOT EXCEEDING 6 VOLTS DC FOR 5 SECONDS.

REF: UL 544, PAR. 33.1A
IEC 601-1, CLAUSE 18, PAR. F

MATERIAL:

FINISH:

QTY S04	QTY S03	QTY S02	QTY S01	ITEM OR SYMBOL	PART NUMBER	DESCRIPTION
						LIST OF MATERIAL

REF. DWGS

UNLESS OTHERWISE SPECIFIED:

METRIC DIMENSIONS (WHEN USED) ARE IN ( ).

DIMENSIONS INCLUDE PLATING.

REMOVE BURRS & SHARP EDGES.

THREADS ARE UNIFIED SERIES AND INCLUDE PLATING:

EXTERNAL THDS = CLASS-2 A

INTERNAL THDS = CLASS-2 B

GROUP OR PART	NEXT ASS'Y	QTY	USED ON
	APPLICATION		

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCES ON:

BASIC DIMENSION	.XX	.XXX
UP TO 6	± .02	± .005
ABOVE 6 TO 24	± .03	± .010
ABOVE 24	± 06	± .015

ANGLES: ± 1/2 DEGREE

DO NOT SCALE

		DATE
DRAWN	R. UHL	4-5-77
CHECKED	D.DANNA	4-5-77
APPROVED	R. UHL	5-13-77
REL. FOR PROD	JCN	6-26-77

WELCH ALLYN, INC.
SKANEATELES FALLS, N.Y. U.S.A

TITLE: GROUNDING CONTINUITY TEST W/NON-DETACHABLE POWER CORD

CODE IDENT. 64475 | B | DRAWING NO. A00172 | REV. E

SCALE NONE | SHEET 1 OF 1

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REV	REVISION DESCRIPTION	ECN	INIT	DATE	APPROVAL
B	REDRAWN ON CAD & CHG'D NOTES.	5-20151	SB	12-27-89	

AT THE CONCLUSION OF MANUFACTURE (INCLUDING ATTACHMENT OF POWER PLUG) AND BEFORE SHIPMENT, EACH UNIT SHALL BE SUBJECTED TO THE FOLLOWING DIELECTRIC STRENGTH TESTS: (IN ACCORDANCE WITH IEC 601-1)

(B) THE TEST SHALL BE MADE BY APPLYING FOR 1 SECOND WITHOUT BREAKDOWN •, A 60Hz POTENTIAL (RMS) AS FOLLOWS:

(B) 1. BETWEEN THE MAINS PART (BOTH SIDES OF SUPPLY TERMINALS CONNECTED TOGETHER) AND ACCESSABLE (CONDUCTIVE) PARTS, 1500 VAC.
REF: PAR 20.1 A-a.

(B) 2. BETWEEN THE OUTPUT CIRCUIT (SECONDARY) AND EXPOSED CONDUCTIVE PARTS, 500 VAC.
REF: PAR 20.1 A-K.

(B) 3. BETWEEN THE MAINS PART (BOTH SIDES OF SUPPLY TERMINALS CONNECTED TOGETHER) AND OUTPUT CIRCUITS (SECONDARY), 1500 VAC.
REF: PAR 20.1 A-e.

• DURING THE TEST, NO FLASHOVER OR BREAKDOWN SHALL OCCUR. SLIGHT CORONA DISCHARGES ARE NEGLECTED, PROVIDED THAT THEY CEASE WHEN TEST VOLTAGE IS TEMPORARILY DROPPED TO A LOWER VALUE, WHICH MUST BE HIGHER, HOWEVER, THAN THE REFERENCE VOLTAGE (250 V.) AND PROVIDED THAT THE DISCHARGES DO NOT PRDVOKE A DROP IN TEST VOLTAGE.
REF: PAR 20.4 f.

DTY 504	DTY 503	DTY S02	DTY S01	ITEM OR SYMBOL	PART NUMBER	DESCRIPTION
						LIST OF MATERIAL

MATERIAL: ~ FINISH: ~

REF. DWGS

UNLESS OTHERWISE SPECIFIED:
METRIC DIMENSIONS (WHEN USED) ARE IN ( ).
DIMENSIONS INCLUDE PLATING.
REMOVE BURRS & SHARP EDGES.
THREADS ARE UNIFIED SERIES AND INCLUDE PLATING:
EXTERNAL THDS = CLASS-2 A
INTERNAL THDS = CLASS-2 B

GROUP OR PART	NEXT ASS'Y	QTY	USED ON
APPLICATION			

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCES ON:

BASIC DIMENSION	.XX	.XXX
UP TO 6	± .02	± .005
ABOVE 6 TO 24	± .03	± .010
ABOVE 24	± .06	± .015

ANGLES: ± 1/2 DEGREE

DO NOT SCALE

		DATE
DRAWN	CRW	4-25-80
CHECKED	JWH	4-28-80
APPROVED	JWH	4-28-80
REL. FOR PROD.	CSH	6-25-80

WELCH ALLYN, INC.
SKANEATELES FALLS, N.Y. U.S.A.

TITLE: DIELECTRIC STRENGTH TEST FOR IEC EQUIPMENT

CODE IDENT.	DRAWING NO.	REV.
64475	A00178	B

SCALE NONE SHEET 1 OF 1

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REV	REVISION DESCR.	ECN	INIT	DATE	APPROVAL
A	RELEASE TO PRO ENG.	[illegible]	ROB	9-26-89	JVL
B	REVD NOTE 11 (WAS 2 SEPARATE NOTES 9 & 10, ADD'D NOTE 12, TP1, ITEM 23 & "MUST SINK....."; 11 VDC WAS 7VDC @ 50mA	[illegible]	CRW	1/5/90	K BURDICK
C	REV'D NOTES 1, 8, 10 & 12	[illegible]	CRW	2/5/90	K BURDICK
D	50ma WAS 45ma (NOTE 5); 2.5ma WAS 1 ma (NOTE 9)	[illegible]	CRW	7/28/90	K BURDICK
E	24mA WAS 40mA (NOTE 5); ADD ACCEPTANCE RANGE (NOTE 8)	[illegible]	SRS	9/5/91	KAB 8/9/91
F	ADD NOTE 1 TO REQUIREMENTS CHANGE TO D-SIZE DRAWING	[illegible]	BMT	1/5/95	PBL

Ⓕ

REQUIREMENTS: 1 BURN IN ASSY (ANALOG BOARD AND DIGITAL BOARD SECURELY CONNECTED WITH THE CABLE CONECTION) FOR 24 HRS. AT 60° C UNDER FULL POWER UP CONDITIONS (0 VDC). (NOTE: FULL POWER UP OCCURS IN PRESSURE CAL. AS INDICATED FOR STEP 8 OF THE PROCEDURE. POWER TO BE APPLIED TO BATTERY CONTACTS)

2 VARIABLE POWER SUPPLY FIXTURE 5-7V, AMMETER, VOLTMETER, HAND TOOLS, Ø TO 6cm H20 MANOMETER

PROCEDURE:

Ⓒ 1 SET UP BOTH BOARDS AT A STATIC-CONTROLLED WORK STATION SO THAT THEY ARE CONNECTED AND ACCESSIBLE. THE PRESSURE AND TEMPERATURE TRANSDUCERS MUST BE ATTACHED. HOSES SHOULD BE ATTACHED TO THE PRESSURE TRANSDUCER FOR LATER USE. USE A JUMPER TO CONNECT THE RX AND TX COMMUNICATION CONTACTS (J3 RED AND J4 WHITE). INITIALLY SET R7, R33 AND R36 TO MID RANGE. 10K LOAD CONNECTED TO TP1 PER Fig 1. 14 VOLT SUPPLY CONNECTED TO CHARGING CONTACTS - OFF.

Ⓑ 2 WITH SW1 OFF, ATTACH THE POWER SOURCE FIXTURE AND AMMETER TO THE BATTERY TERMINALS. ADJUST THE POWER SUPPLY TO 6.9 VOLTS ±0.05V. SEE FIGURE 1.

3 HOLD DATA KEY DOWN WHILE TURNING THE UNIT ON. THE UNIT SHOULD BEEP. THEN LET THE DATA KEY UP. IT SHOULD BEEP AGAIN. IF IT FAILS TO BEEP OR IMMEDIATELY DRAWS EXCESSIVE CURRENT (50ma), REJECT THE UNIT.

4 MEASURE V_{DD} AT A CONVENIENT POINT. (e.g. PIN 28 OF THE EPROM.) AND VERIFY THAT IT IS 5 VOLTS ±.1 VOLTS.

5 THE LCD DISPLAY SHOULD NOW HAVE ALL SEGMENTS ACTIVE. ADJUST R7 UNTIL ALL SEGMENTS ARE VISIBLE WHILE VIEWING AT PERPENDICULAR TO DISPLAY.

Ⓓ Ⓔ CHECK THE POWER CONSUMPTION AND VERIFY THAT IT IS LESS THAN 24mA.

6 PRESS THE "TEST" KEY AND OBSERVE THE DISPLAY. IT SHOULD DISPLAY "TEST)NO." "ROM OK." "RAM OK." AND "EEPRM OK" IN SEQUENCE. IF THESE TESTS FAIL IT WILL DISPLAY AN ERROR MESSAGE SUCH AS "RAM BAD".

7 WHEN TESTS ARE COMPLETE IT WILL DISPLAY "ASLEEP" AND POWER DOWN THE PROCESSOR.

ADJUST R7 AGAIN IF NECESSARY SO THAT LCD SEGMENTS THAT ARE NOT CURRENTLY ACTIVE ARE NOT VISIBLE WHILE VIEWING AT PERPENDICULAR TO DISPLAY.

Ⓓ CHECK THE POWER CONSUMPTION AND VERIFY THAT IT IS LESS THAN 2.5 ma.

Ⓒ Ⓔ 8 PRESS "TEST" AGAIN. THE UNIT WILL ENTER THE FULL ON STATE. IT WILL POWER UP THE ANALOG CIRCUITRY AND THE CHARGE PUMP AND DISPLAY THE CHANNEL 0 A/D READING. CHECK THE POWER CONSUMPTION AND VERIFY THAT IT IS LESS THAN 35 ma.

CHECK THAT: TP 2 IS 4v±0.1v
TP 3 IS -4v±0.1v
TP 0 IS 5v±0.1v
TP 4 IS 0.95v±0.1v

CONNECT A MANOMETER TO THE LONGER TRANSDUCER HOSE AND REFINE THE ADJUSTMENT OF POTENTIOMETERS R33 AND R36 UNTILL

ON WITH 0 cm H20, DISPLAY: 50±20 (R33 = OFFSET)

ON WITH 8 cm H20: DISPLAY: 844±20 (R36 = GAIN)

CHECK THAT THE DIFFERENCE BETWEEN THE TWO NUMBERS IS 794±20. IF NOT RECALIBRATE.

AT ALL TIMES THE A/D READINGS ON THE DISPLAY MUST SETTLE TO ± ONE VALUE.

REMOVE THE MANOMETER AND APPLY THE LOCKING COMPOUND TO THE POTENTIOMETERS.

W/A ACCEPTANCE RANGE FOR SETTINGS, OFFSET = 30 TO 80, GAIN = 814 TO 874,
DIFFERENCE = 774 TO 814

9 PRESS THE "TEST" KEY AND DISPLAY WILL READ 815±1%.

Ⓒ 10 PRESS THE "TEST" KEY. THE UNIT WILL DISPLAY THE TEMPERATURE OF THE SENSOR. THIS DEVICE IS TRIMMED BY THE MANUFACTURER SO THAT NO ADJUSTMENT IS NECESSARY. IF THE VALUES APPEAR REASONABLE, ROOM TEMPERATURE IN °F, THEN TOUCH THE SENSOR WITH A FINGER. AN OBVIOUS RISE IN TEMPERATURE SHOULD RESULT. (FAILURE MAY INDICATE "LOW BAT" PROBLEM OR COLD FINGER.)

11

Ⓒ Ⓑ 12 PRESS THE "TEST" KEY 3 TIMES. THE UNIT WILL ENTER A TEST OF THE CHARGER VOLTAGE (DCV) SENSE AND THE COMMUNICATIONS (RX AND TX).

THE UNIT SHOULD DISPLAY "DO DCV".

APPLY 14 VDC ± 1.0V TO THE CHARGIND CONTACTS J3 FOR V+ (WHITE) AND J4 FOR GND (RED). THE UNIT SHOULD DISPLAY "DCV SEEN" AND PROCEED TO TEST RX AND TX. IF THERE ARE NO PROBLEMS IT WILL DISPLAY "RX1X OK" AND THEN "CHARGE" AND THEN GO TO SLEEP WITH THE DISPLAY BLANK. VERIFY THAT LED LIGHTS.
THE VOLTAGE AT TP 1 SHOULD BE 7.7 - 9.6.

TURN THE OUTPUT OF THE POWER SUPPLY ATTACHED TO THE BATTERY CONTACT TO ZERO. THE CHARGE CURRENT INTO THE BATTERY CONTACTS SHOULD BE VERIFIED TO BE -12ma±2ma. RETURN THE BATTERY VOLTAGE TO 6.9 VOLTS AND REMOVE THE 14 VOLT CHARGING VOLTAGE.

THE MESSAGE "DO DCV" SHOULD AGAIN APPEAR.

13 PRESSING THE "TEST" KEY ONCE MORE WILL RETURN TO STEP 5 ABOVE.

Ⓑ 14 REMOVE THE TEST JUMPER AND CYCLE THE POWER SWITCH 3 TIMES. THE UNIT SHOULD DISPLAY THE "CLEAR" MESSAGE EACH TIME BEFORE GOING INTO THE "SELECT" MODE VERIFY THAT "LOW BAT" DOES NOT APPEAR ON LCD

Ⓑ 15 REDUCE 6.9V SUPPLY TO 6.0±0.05 VOLTS AND PRESS S3. VERIFY THAT "LOW BAT" APPEARS.

THIS COMPLETES THE BOARD LEVEL CHECK OF THE SPIROMETER.

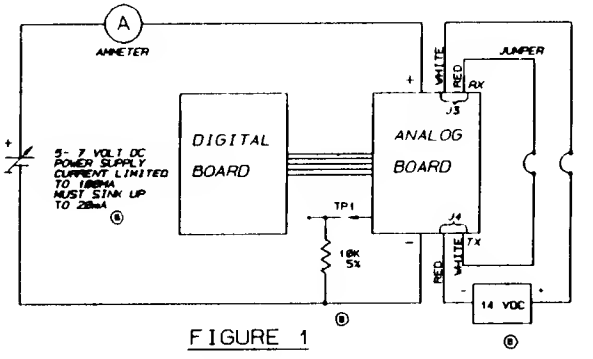

FIGURE 1

MATERIAL:	PART NO		DESCRIPTION
	DRAWN ROB B BEMILLA	DATE 1-13-89	Welch Allyn SKANEATELES FALLS, NEW YORK U.S.A.
FINISH:	DESIGNED		TITLE: SPIROMETER BOARD LEVEL TESTING
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES AND INCLUDE PLATING .TOLERANCES- XX ±.02 ANGLES: ±1/2° .XXX ±.005 TOLERANCES PER ANSI Y14.5 REMOVE BURRS & SHARP EDGES EXTERNAL THDS= CLASS: 2A INTERNAL THDS= CLASS: 2B	CHECKED J.S	10/3/89	
	APPROVED JVL	9/29/89	CODE IDENT 64275 D DRAWING NO A01943 REV F
	REL TO PROD BC	10/5/89	SCALE NONE DO NOT SCALE SHEET 1 OF 1

C	AØ1945	D

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REV	REVISION DESCRIPTION	ECN	INIT	DATE	APPROVAL
A	RELEASE TO PROD. ENG.	S-19751	RDB	9-26-89	JVL
B	2.94 & 3.06 LITERS(±2%) WERE 2.98 & 3.02 (NOTE 3 ACC TEST)	S-28760	CRW	4/2/90	JVL
C	REV'D NOTE 5; ADD'D GENERAL NOTES 1 & 2	S-28917	CRW	4/16/90	JVL
D	ADD OPTIONAL QUALITY CHECK	S-23330	SRS	9/5/91	

PERFORMING A CALIBRATION WITH A 3 LITER SYRINGE REQUIRES SOME CARE. PLEASE NOTE THESE ITEMS:

1. A HOSE THAT IS BETWEEN THREE AND FOUR FEET LONG SHOULD BE USED.
2. THE HOSE SHOULD BE ATTACHED TO THE OUTSIDE OF THE SPIROMETER MOUTHPIECE.
3. THE CONNECTION SHOULD BE LEAK PROOF.
4. THERE MUST BE NO OBSTRUCTION IN THE AIRSTREAM FOR AT LEAST 12 INCHES AHEAD OF THE SPIROMETER.

WHEN PERFORMING THE CALIBRATION MANEUVER, NOTE THIS:

1. THE MOVEMENT OF THE PLUNGER SHOULD BE SMOOTH AND WITHOUT HESITATION OR JERKS
2. THE PLUNGER MUST NOT SLAM AGAINST THE ENDS OF THE SYRINGE.
3. MANEUVERS SHOULD ALWAYS BE BETWEEN 1/2 AND 6 SECONDS LONG
4. THE PLUNGER MUST MOVE ALL THE WAY FROM LIMIT TO LIMIT.

MODE OPERATION:

NORMAL MODE IS INVOKED BY SIMPLY TURNING THE UNIT ON.

TEST MODE IS INVOKED BY TURNING THE UNIT ON WHILE HOLDING DOWN THE TEST BUTTON.

TO GO FROM TEST MODE TO NORMAL MODE: TURN THE UNIT OFF. THEN BACK ON AGAIN.

CALIBRATION

NOTE: CALIBRATION CAN BE PERFORMED IN EITHER NORMAL OR TEST MODE. IT IS ADVISABLE TO PLACE THE UNIT IN THE TEST MODE THROUGHOUT THE TESTING PROCEDURE IN ORDER TO SAVE TIME.

1. CONNECT THE 3 LITER SYRINGE TO THE PNEUMOTACH AND TURN ON THE SPIROMETER WHILE HOLDING DOWN THE TEST BUTTON. THIS WILL PUT THE UNIT IN THE TEST MODE. THE MESSAGE "TEST.MODE" WILL APPEAR BRIEFLY. WHEN THE MESSAGE "SELECT" IS DISPLAYED, PRESS THE "TEST" BUTTON THREE TIMES TO SELECT THE CALIBRATION MODE. THE WORD "CAL" SHOULD APPEAR ON THE DISPLAY BRIEFLY
2. WHEN THE MESSAGE "PULL.BACK" APPEARS, YOU SHOULD PULL BACK THE PLUNGER OF THE SYRINGE. THE MESSAGE "STEADY" WILL THEN APPEAR FOLLOWED BY THE MESSAGE RETRIM. THE SPIROMETER WILL THEN ESTABLISH A NEW BASELINE FOR ZERO FLOW. THIS WILL TAKE ABOUT 45 SECONDS.
3. WHEN THE MESSAGE "DO CAL 1" IS DISPLAYED, WAIT ONE SECOND AND THEN PUSH THE PLUNGER ALL THE WAY FORWARD USING AN EVEN, CONSISTENT MOTION.
4. THE SPIROMETER WILL DISPLAY THE MESSAGE "BUSY" BRIEFLY AND THEN THE MESSAGE "PULL.BACK" AGAIN. THREE MANEUVERS MUST BE COMPLETED IN ORDER TO RECALIBRATE THE UNIT. SO REPEAT STEP THREE TWICE MORE. NOTICE THAT WITH EACH SUBSEQUENT CALIBRATION MANEUVER, THE MESSAGE "DO CAL 2" AND "DO CAL 3" WILL APPEAR INSTEAD OF "DO CAL 1".

(C) 5. ONCE THE THREE MANEUVERS HAVE BEEN COMPLETED, THE SPIROMETER WILL CALCULATE THE AVERAGE VOLUME OF THE THREE MANEUVERS. EACH MANEUVER IS THEN COMPARED TO THIS CALCULATED AVERAGE, AND IF ALL THREE ARE WITHIN 0.5% OF IT, THE CALIBRATION VALUE IS UPDATED, AND DISPLAYED FOR TWO SECONDS AS CF=XXXX. THIS CF VALUE SHOULD BE BETWEEN 1200 AND 2000, AND BE RECORDED. NEXT, THE MESSAGE "GOOD CAL" IS DISPLAYED, AND THE SPIROMETER PAUSES UNTIL YOU PRESS A BUTTON.

6. IF ANY OF THE CALIBRATION MANEUVERS WERE NOT WITHIN 0.5% OF THE CALIBRATED AVERAGE, THE MESSAGE "RETRY.CAL" IS DISPLAYED, AND THE EXISTING CALIBRATION FACTOR IS NOT UPDATED. ANOTHER CALIBRATION SHOULD THEN BE ATTEMPTED.
7. IF THE SPIROMETER WAS SUCCESSFULLY CALIBRATED, PERFORM THE ACCURACY TEST.

ACCURACY TEST

IF THE SPIROMETER CALIBRATION IS IN QUESTION THERE IS A SIMPLE ACCURACY TEST TO VERIFY ITS CALIBRATION.

1. WITH THE SPIROMETER IN THE TEST MODE, PULL BACK THE PLUNGER OF THE SYRINGE AND SELECT THE "FVC" MODE.
2. THE "STEADY" MESSAGE WILL APPEAR FOLLOWED BY "DO FVC 1" AT THIS TIME PUSH THE PLUNGER ALL THE WAY FORWARD.

(B) 3. THE "BUSY" MESSAGE WILL THEN APPEAR FOLLOWED BY "TEST.MODE". PRESS THE DATA BUTTON TO OBTAIN THE FVC DATA. THE RESULTING VOLUME SHOULD BE BETWEEN 2.94 AND 3.06 LITERS (±2%).

GENERAL

(C) 1. CALIBRATION SHOULD BE ATTEMPTED THREE TIMES ON EACH SPIROMETER. A GOOD UNIT WILL CALIBRATE AT LEAST TWO OF THE THREE ATTEMPTS.

(C) 2. AFTER A SUCCESSFUL ACCURACY TEST, VERIFY DATA TRANSMISSION BY PLACING THE SPIROMETER IN A KNOWN GOOD PRINTER AND OBTAINING A PRINTOUT.

(D) ØPTIONAL QUALITY CHECK

THE BOARD SET MAY BE CHECKED ACCROING TO THE VENDOR BOARD LEVEL TEST (AØ1943 OR SUCCESSOR) WITH THE FOLLOWING DIFFERENCES.

1. THE ACCEPTANCE RANGE FOR TRANSDUCER OFFSET ("ON" READING) IS INCREASED BY ± 10 COUNTS.
2. THE ACCEPTANCE RANGE FOR READING AT 6CM WATER INCREASES BY ± 10 COUNTS. NO INCREASE IN 6 CM/Ø CM DIFFERENCE IS ALLOWED.

QTY 504	QTY 503	QTY 502	QTY 501	ITEM OR SYMBOL	PART NUMBER	DESCRIPTION
						LIST OF MATERIAL

MATERIAL:

FINISH:

REF. DWGS

UNLESS OTHERWISE SPECIFIED:

METRIC DIMENSIONS (WHEN USED) ARE IN ( ).

DIMENSIONS INCLUDE PLATING

REMOVE BURRS & SHARP EDGES.

THREADS ARE UNIFIED SERIES AND INCLUDE PLATING:

EXTERNAL THDS = CLASS-2 A

INTERNAL THDS = CLASS-2 B

GROUP OR PART	NEXT ASS'Y	QTY	USED ON

APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCES ON:

BASIC DIMENSION	.XX	.XXX
UP TO 6	± .02	± .005
ABOVE 6 TO 24	± .03	± .010
ABOVE 24	± .06	± .015

ANGLES: ± 1/2 DEGREE

DO NOT SCALE

DRAWN	ROBB D BONILLA	1-17-89
CHECKED	JJS	10/5/89
APPROVED	JVL	10/5/89
REL. FOR PROD.	BC	10/5/89

WELCH ALLYN, INC.
SKANEATELES FALLS, N.Y. U.S.A.

TITLE: CALIBRATING THE WELCH ALLYN SPIROMETER

CODE IDENT 84475	DRAWING NO.	REV.
C	AØ1945	D

SCALE NS SHEET 1 OF 1

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REV	REVISION DESCRIPTION	ECN	INIT	DATE	APPROVAL
A	RELEASE TO PRO. ENG.	S-19751	RDB	9-26-89	JVL
B	REV'D NOTES; UPDATE FIG PER ENG	S-21982	CRW	11/1/90	

⑥ REQUIREMENTS: KNOWN GOOD PRINTER MECHANISM 76108S, TRANSFORMER 761071, AND SWITCH PCB'S 761031 & 761041.

PROCEDURE:

1. SET UP THE PRINTER BOARD AT A STATIC CONTROLLED WORK STATION. CONNECT THE SWITCH BOARDS. ATTACH A PRINTER MECHANISM (WITH PAPER LOADED) AND A FUSED POWER TRANSFORMER.
2. CONNECT THE RX AND TX CONTACTS WITH A JUMPER WIRE.
3. SHORT THE TEST JUMPER POINTS (JP1) ON THE MAIN BOARD TOGETHER. (SEE FIGURE 1).
4. PLACE THE PAPER RELEASE LEVER IN THE FORWARD (HEAD OUT OF CONTACT) POSITION.
5. SUPPLY THE FUSED POWER TRANSFORMER WITH A 90 VOLT AC (±1.0 V) 60Hz INPUT.
6. TURN ON THE POWER SUPPLY. THE BOARD SHOULD BEEP AT ONCE IF IT FAILS TO BEEP OR THE BREAKER BREAKS, REJECT THE UNIT
   IF THE PRIMARY CURRENT DRAW IS GREATER THAN TBDma THEN REJECT THE UNIT.
   THE UNIT WILL CONTINUE TO BEEP AT APPROX 1 SEC INTERVALS.
7. MEASURE THE 24V, 14V AND 5V POWER VOLTAGES TO ENSURE THAT THEY ARE WITHIN ACCEPTABLE LIMITS:
   24V: 23.4 TO 25.1
   14V: 13 TO 15V - AT EXTERNAL CONTACTS
   5V: 4.75 TO 5.75V
   NOTE: METER MUST BE GROUNDED AT DC GND (i.e. WELL CONTACT "GND" PAD).
   DO NOT USE J4 POWER INPUT.
8. VERIFY THAT RT1 IS SET TO MID RANGE. (THIS IS TO ASSURE THAT THERE IS NO PRINTER DAMAGE BEFORE THE FINAL PRINTER CONTRAST IS SET IN STEP 11.)
9. MOVE THE PAPER RELEASE LEVER TO THE REAR (PRINT HEAD IN CONTACT WITH THE PAPER). BEEPING WILL STOP.

   THE UNIT WILL PRINT A HEADER LINE AND PROCEED TO TEST RAM, ROM AND THE UART. APPROPRIATE MESSAGES WILL BE PRINTED.

   THE SOFTWARE VERSION WILL ALSO BE PRINTED AT THIS TIME. VERIFY THAT THE SOFTWARE VERSION NUMBER THAT IS PRINTED IS THE SAME AS THE VERSION FOR CURRENT PRODUCTION.

   AT THIS POINT THE "PRINT" AND "FEED" KEYS ARE ACTIVE AS FOLLOWS:

   FEED: FEEDS THE PAPER.
   PRINT. WILL PRINT THE STATUS OF THE:
   A) THERMISTOR
   B) OPTIONS DIP SWITCH
   C) DEMOGRAPHIC SETTINGS

   ONE CAN PRESS "PRINT" REPEATEDLY WHILE CHANGING THE SWITCH SETTINGS ON THE FRONT PANEL AND THE OPTIONS SWITCHES TO VERIFY THAT THESE ARE BEING PROPERLY READ.
10. VERIFY THAT THE FOLLOWING THREE PATTERNS ARE CORRECTLY DETECTED:

AGE	HEIGHT	RACE	SEX	OPTIONS		VALUE
36	369	1	F	OFF-ON-OFF-ON	=	10
63	693	2	F	OFF-ON-ON-OFF	=	6
99	936	2	M	ON-OFF-ON-OFF	=	5

11. SET RT1 SO THAT THE THERMISTOR READING IS 200(±5).
12. REMOVE THE TEST JUMPER FROM JP1 AND THE RX TX JUMPER. TURN OFF THE POWER SUPPLY. WAIT FOR THE "POWER" LED TO GO OUT. TURN THE POWER BACK ON.
13. OPEN THE CONNECTION AT J1 PIN 8 BETWEEN THE BOARD AND THE PRINTER. THIS WILL SIMULATE AN "OUT OF PAPER" CONDITION.
14. HOLD DOWN THE "PRINT" KEY AND PRESS THE "RESET" KEY. THE UNIT SHOULD BEEP AND FLASH THE GREEN LED GIVING THE "PAPER OUT" SIGNAL. (THE UNIT SHOULD NOT PRINT THE TEST PATTERN.)
15. CLOSE THE CONNECTION AT J1 PIN 8 AND PRESS THE RED "RESET" BUTTON
16. HOLD DOWN THE "PRINT" KEY AND PRESS THE "RESET" KEY. THE UNIT SHOULD PRINT THE TEST PATTERN

THIS COMPLETES THE BOARD LEVEL FUNCTIONAL TEST OF THE PRINTER.

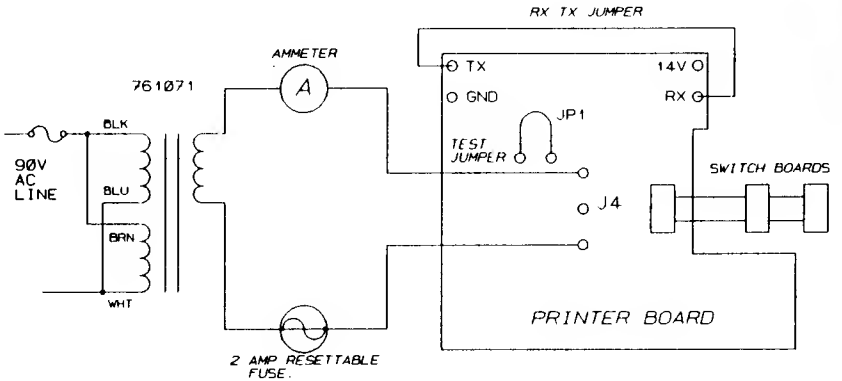

FIGURE 1 ⑥

QTY 584	QTY 583	QTY 582	QTY 581	ITEM OR SYMBOL	PART NUMBER	DESCRIPTION
						LIST OF MATERIAL

MATERIAL:

FINISH:

REF: DWGS

UNLESS OTHERWISE SPECIFIED:
METRIC DIMENSIONS (WHEN USED) ARE IN ( )
DIMENSIONS INCLUDE PLATING
REMOVE BURRS & SHARP EDGES.
THREADS ARE UNIFIED SERIES AND INCLUDE PLATING:
EXTERNAL THDS = CLASS-2 A
INTERNAL THDS = CLASS-2 B

GROUP OR PART | NEXT ASS'Y | QTY | USED ON | APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON:

BASIC DIMENSION	.XX	.XXX
UP TO 6	± .02	± .005
ABOVE 6 TO 24	± .03	± .010
ABOVE 24	± .06	± .015

ANGLES: ± 1/2 DEGREE
DO NOT SCALE

		DATE
DRAWN	ROBB D BONILLA	1-17-89
CHECKED	JJS	10/5/89
APPROVED	JVL	9/29/89
REL FOR PROD	BC	10/6/89

WELCH ALLYN, INC.
SKANEATELES FALLS, N.Y. U.S.A.

TITLE: PRINTER BOARD LEVEL TESTING

CODE IDENT. 64475 | C | DRAWING NO. A01946 | REV. B

SCALE NS | SHEET 1 OF 1

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REV	DESCRIPTION	ECN	INIT	DATE	APPR
A	RELEASE TO PROD. ENG.	5-20587	RDB	3-8-90	JVL
B	SEE ECN	5-20753	RJG	3/29/90	PL
C	0.32 WAS 0.27, 0.73 WAS 0.78	5-21031	RJG	5/7/90	PL
D	ADDED OPERATING INSTRUCTIONS	5-21793	RJG	10/10/90	

THE MODEL 61000 WELCH ALLYN SPIROMETER SHALL BE SUBJECTED TO DYNAMIC WAVEFORM TESTING UPON COMPLETION OF FINAL ASSEMBLY OR WHENEVER THE UNIT UNDERGOES REPAIR OR CALIBRATION. THE FOLLOWING CONDITIONS APPLY:

1- MEASUREMENTS TO BE DONE ON UNITS CALIBRATED WITH A REFERENCE 3.0 LITER SYRINGE (NOTE: CALIBRATION PER ASPEC A01945)

2 - MEASUREMENTS TO BE DONE IN "TEST MODE"

* 3 - WAVEFORMS *13, *15, AND *23 TO BE SELECTED FROM THE WAVEFORM GENERATOR (D) MENU IN THE "H" WAVEFORM MENU.

4 - USING WAVEFORMS (*13, *15, AND *23) MEASURE AND RECORD FVC, FEV1, AND MMEF.

5 - FOR EACH OF THE FVC, FEV1 AND MMEF VALUES RECORDED, THE RESULT SHOULD BE BETWEEN (INCLUSIVE OF) THE HIGH AND LOW VALUES. SPIROMETER MEASUREMENTS TO BE RECORDED PER THE TABLE BELOW.

SPIROMETER DYNAMIC WAVEFORM TEST

	FVC			FEV1			MMEF		
H13	(B) 4.67	(B) 5.16		(B) 3.67	(B) 4.06		3.45	3.96	
H15	(B) 5.68	(B) 6.28		(B) 5.08	(B) 5.62		(B) 5.67	(B) 6.52	
H23	(B) 3.24	(B) 3.58		1.31	1.46		(C) 0.32	(C) 0.73	

(D) * SEE TESTING PROCESS FOR WAVEFORM GENERATOR SYSTEM.

TESTING PROCESS FOR WAVEFORM GENERATOR

1. LOAD SPIROMETER INTO T9125 HOLDING FIXTURE
2. TURN ON THE SPIROMETER IN TEST MODE (HOLD DOWN TEST BUTTON WHILE TURNING UNIT ON).
3. ON WAVEFORM GENERATOR (WFG) COMPUTER TERMINAL TYPE THE "W" KEY TO SELECT A WAVE FORM. THEN TYPE H13 AND PRESS ENTER. WHEN "PRESS 'R' TO RUN WAVEFORM" IS ON THE DISPLAY, TYPE "R".
4. ON THE SPIROMETER PRESS THE "TEST" BUTTON UNTIL SPIRO DISPLAYS 'FVC'.
5. WHEN THE SPIRO DISPLAYS "DO FVC 2**" STRIKE ANY KEY ON THE WFG TERMINAL.
6. OBSERVE THE SPIRO DISPLAY. WHEN "TEST MODE" IS DISPLAYED PRESS THE "DATA" KEY FOR THE FVC, FEV1, AND MMEF VALUES AND RECORD.
7. PRESS THE SPIRO "TEST" KEY TO MAKE ANOTHER SELECTION ('SELECT')
8. REPEAT STEPS 3 THRU 7 FOR WAVEFORMS H1S AND H23.

(D) ** MAY BE ANY NUMBER

MATERIAL: N/A	PART NO.		DESCRIPTION
	DRAWN: RDB	DATE: 3-8-90	Welch Allyn SKANEATELES FALLS, NEW YORK U.S.A.
FINISH: N/A	DESIGNED: N/A		TITLE: DYNAMIC WAVEFORM TESTING
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES AND INCLUDE PLATING -TOLERANCES- .XX =±.02 ANGLES. ±1/2° .XXX =±.005 TOLERANCES PER ANSI Y14.5 REMOVE BURRS & SHARP EDGES EXTERNAL THDS= CLASS- 2A INTERNAL THDS= CLASS- 2B	CHECKED		
	APPROVED: JVL	3/9/90	CODE IDENT 64475: B; DRAWING NO.: A01951; REV: D
	REL TO PROD: BC	3/12/90	SCALE: NONE; DO NOT SCALE; SHEET: 1 OF 1

B A01951 D

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REV	REVISION DESCRIPTION	ECN	INIT	OATE	APPROVAL
A	RELEASE TO PROD. ENG.	S-19751	RDB	9-26-89	JVL
B	ADDED NOTE 13.	S-20264	RJG	2/12/90	BC
C	REV'D NOTE 1	S-20327	CRW	4/30/90	JVL
D	REV'D NOTES 3 & 9	S-22420	CRW	2/5/91	JVL
E	ADD'D NOTE 14	S-22627	CRW	3/25/91	JVL
F	REV'D NOTES 13 & 14	S-24766	SRS	7/30/92	

1. APPLY POWER TO THE UNIT (PER NOTE 13). IT SHOULD BEEP TWICE AND THE POWER LED SHOULD LIGHT. THE DATA LED SHOULO REMAIN OFF. THIS TEST WILL BE PERFORMED AFTER 761000, NOTE 6 TESTS TO INSURE OPERATOR SAFETY.
2. PUSH THE PRINT BUTTON. THE UNIT SHOULO BEEP TO INOICATE IT HAS NO OATA TO PRINT.
3. WITH THE FVC AND THE MVV MANEUVER IN THE SPIROMETER, TRANSMIT THE DATA TO THE PRINTER BY PLACING THE SPIROMETER INTO THE PRINTER WELL. VERIFY CORRECT OPERATION OF THE DATA LED (IT SHOULD FLASH DURING TRANSMISSION). LISTEN FOR THE TRIPLE BEEP TO SIGNAL THE END OF TRANSMISSION. THE DATA LED SHOULD NOW REMAIN LIGHTED. REMOVE THE SPIROMETER FROM THE PRINTER WELL.
4. CLOSE THE PAPER RELEASE (PUSH LEVER TOWAROS THE BACK) AND ATTEMPT TO PRINT WITH NO PAPER. THE DATA LED SHOULD FLASH. PUSH THE STOP BUTTON TO RESET THE UNIT.
5. OPEN THE PAPER RELEASE (PULL LEVER TOWAROS THE FRONT). INSTALL THE ROLL OF PAPER. CLOSE THE PAPER RELEASE.
6. VERIFY THE OPERATION OF THE FEED BUTTON.
7. OPEN THE PAPER RELEASE, ATTEMPT TO PRINT. THE DATA LED SHOULD FLASH. PUSH THE STOP BUTTON TO RESET THE PRINTER. CLOSE THE PAPER RELEASE
8. HOLD DOWN THE FEEO BUTTON AND PRESS THE STOP BUTTON. THE PAPER SHOULD FEED BACKWARDS.
9. HOLD DOWN THE PRINT BUTTON AND PRESS THE STOP BUTTON. THE UNIT SHOULD PRINT THE TEST PATTERN.
10. SET UP THE FOLLOWING: AGE-36, HEIGHT-159, RACE-2, SEX-FEMALE, DIP SWITCHES- ALL OFF. PRINT A TEST AND VERIFY THAT THE SWITCHES ARE PROPERLY READ.
11. CHANGE THE SWITCHES TO: AGE-59, HEIGHT-096, RACE-1, SEX-MALE, DIP SWITCHES- ALL ON. AGAIN PRINT A TEST AND VERIFY THAT THE SWITCHES ARE PROPERLY READ.
12. REMOVE AND SAVE THE PRINTOUT FOR SHIPMENT WITH THE UNIT.

THIS COMPLETES THE FINAL TEST OF THE PRINTER

13. POWER FOR TEST OF PRINTER BASE:

VERSION	MODEL	VOLTAGE	Hz
DOMESTIC	76100	115 ±5V	60
SPIROMETER PRNTR/CHRGR	76101	115 ±5V	60
EUROPEAN	76102	230 ±10V	50
U.K.	76104	230 ±10V	50
AUSTRALIAN	76106	230 ±10V	50
FINNISH	76108	230 ±10V	50

USE TRUE RMS METER TO MEASURE INPUT VOLTAGE

14. SET ALL DIP SWITCHES TO "OFF" POSITION PRIOR TO SHIPPING. THIS WILL ENSURE SHORT FORM, FLOW, FLOW/VOLUME PRINTOUTS AND FOLLOWING PREDICTED:

VERSION	MODEL	PREDICTED
DOMESTIC	76100	KNUDSON '83
SPIROMETER PRNTR/CHRGE	76101	KNUDSON '83
EUROPEAN	76102	KNUDSON '83
U.K.	76104	KNUDSON '83
AUSTRALIAN	76106	KNUDSON '83
FINNISH	76108	VILJANEN '82

MATERIAL:

FINISH:

QTY 504	QTY 503	QTY 502	QTY 501	ITEM OR SYMBOL	PART NUMBER	DESCRIPTION
					LIST OF MATERIAL	

REF. DWGS

UNLESS OTHERWISE SPECIFIED:
METRIC DIMENSIONS (WHEN USED) ARE IN ( ).
DIMENSIONS INCLUDE PLATING.
REMOVE BURRS & SHARP EDGES.
THREADS ARE UNIFIED SERIES AND INCLUDE PLATING:
EXTERNAL THDS = CLASS-2 A
INTERNAL THDS = CLASS-2 B

GROUP OR PART	NEXT ASS'Y	QTY	USED ON
APPLICATION			

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCES ON:

BASIC DIMENSION	.XX	.XXX
UP TO 6	± .02	± .005
ABOVE 6 TO 24	± .03	± .010
ABOVE 24	± .06	± .015

ANGLES: ± 1/2 DEGREE

DO NOT SCALE

		OATE
DRAWN	ROBB D BONILLA	2-1-89
CHECKED	BC	2/6/90
APPROVED	JVL	9/29/89
REL. FOR PROD.	BC	10/6/89

WELCH ALLYN, INC.
SKANEATELES FALLS, N.Y. U.S.A.

TITLE: PRINTER BASE FINAL TEST

CODE IDENT		DRAWING NO	REV.
64475	B	A01958	F

SCALE NONE

SHEET 1 OF 1

B A01958 F

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REV	DESCRIPTION	ECN	INIT	DATE	APPR
A	RELEASE TO PROD. ENG.	5-21943	CCS	10-15-90	RDS
B	REVISE TEXT, SEE ECN	5-23315	CCS	12/7/91	RDS
C	REVISE TEXT SEE ECN	5-28943	R GRAY	8-23-94	RDS
D					

TITLE: (B)

GROUNDING CONTINUITY TEST FOR PATIENT CONNECTED AND NON-PATIENT CONNECTED EQUIPMENT WITH DETACHABLE POWER CORD.

(C) AT THE CONCLUSION OF MANUFACTURING AND BEFORE SHIPMENT, EACH UNIT SHALL BE SUBJECTED TO ONE OF THE FOLLOWING GROUNDING CONTINUITY TESTS.

(C)(B) 1. THE RESISTANCE BETWEEN THE GROUNDING PIN IN THE APPLIANCE INLET AND ANY ACCESSIBLE METAL PART OF THE APPLIANCE SHALL NOT EXCEED Ø.1 OHM.

(C) 2. THE TOTAL RESISTANCE OF THE APPLIANCE AND THE POWER SUPPLY CORD SHALL NOT EXCEED Ø.2 OHM. TEST WILL BE CONDUCTED USING A 1Ø AMP CURRENT SOURCE WITH A NO-LOAD VOLTAGE NOT EXCEEDING 6 VOLTS DC FOR 5 SECONDS.

REF: UL 544, PAR.33.1
IEC 6Ø1-1, CLAUSE 18, PAR. F

MATERIAL:	PART NO.		DESCRIPTION
	DRAWN C.C.S	DATE 10-15-90	Welch Allyn SKANEATELES FALLS, NEW YORK U.S.A.
FINISH:	DESIGNED		TITLE: GROUNDING CONTINUITY TEST W/DETACHABLE POWER CORD
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES AND INCLUDE PLATING. -TOLERANCES- .XX =±.02 ANGLES: ±1/2° .XXX =±.005 TOLERANCES PER ANSI Y14.5 REMOVE BURRS & SHARP EDGES EXTERNAL THDS= CLASS- 2A INTERNAL THDS= CLASS- 2B	CHECKED PL	10/17/90	
	APPROVED WBB	10/17/90	CODE IDENT 64475 B ORAWING NO. A02242 REV C
	REL TO PROD RDS	10/17/90	SCALE DO NOT SCALE SHEET 1 OF 1

B A02242 C

610041 T

THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY OF WELCH ALLYN, INC. AND SHALL NOT BE REPRODUCED OR COPIED OR USED AS A BASIS FOR MANUFACTURE OR SALE OF EQUIPMENT OR DEVICES WITHOUT WRITTEN PERMISSION.

REV	REVISION DESCRIPTION	ECN	INIT	DATE	APPROVAL
K	REL TO W.A. PROD ENG	36666	CRW	10/11/89	JVL 10-11-89
L	REVISED PER U4	36888	RDB	11-28-89	JVL
M	REV'D C2 & C3	36981	CRW	1/5/90	K BURDICK 1-19-90
N	DELETED ITEM 12, REVISED NOTES 4 AND 9 PER CRW 610102 PER REV C.	36917	RDB	2-8-90	K BURDICK
P	REV'D U4 (VERSION 3.2 SOFTWARE)	37066	CRW	4/5/90	JVL
R	ADD'D THIS DWG-502, DELETED ITEM 12, REVISED NOTES 4 AND 9 PER CRW 610102 PER REV C. REVISED NOTES 4 & 9 PER CRW 610102 PER REV C. ADD'D ITEMS 16 & 17 (SCREWS) ITEM 8	37088	CRW	7/20/90	JVL
S	ADD'D THIS DWG-503	37217	CRW	9/19/90	K BURDICK
T	REV U4 (VERSION 3.3) ADD NOTE 15	37362	SPB	9/7/91	

NOTES:

1 - COMPONENTS ARE TO BE LOCATED AS SHOWN, AND MOUNTED SO AS TO MINIMIZE THE DISTANCE BETWEEN COMPONENTS AND ITEM 1 (PCB)

2 - ITEMS 9, 11 AND LED ARE TO BE WAVE SOLDER ATTACHED TO ITEM 1 (PCB) USING EUTECTIC SOLDER. ALL OTHER COMPONENTS EXCEPT FOR SW1, SW2, SW3, AND TR1 ARE TO BE REFLOW SOLDERED ON TOP OF ITEM 1 (PCB) USING THE APPROPRIATE SOLDER PASTE.

3 - COMPONENTS SW1, SW2, SW3, AND TR1 ARE TO BE SOLDER ATTACHED TO ITEM 1 (PCB) USING EUTECTIC SOLDER. THESE COMPONENTS CANNOT BE WAVE SOLDERED. A MANO SOLDERING OPERATION IS RECOMMENDED.

4 - A FREON SOLUBLE FLUX IS TO BE USED DURING THE SOLDERING OPERATIONS, AND FLUX REMOVAL AFTER SOLDERING SHOULD BE DONE USING A FREON TMS SOLUTION. BE SURE THAT THE ASSEMBLY IS FREE OF ANY RESIDUAL CLEANING FLUID.

5 - THE LED IS TO BE MOUNTED AT 90 DEGREES FROM THE ITEM 1 (PCB), WITH THE ANODE (LONGER LEAD) LOCATED IN THE HOLE WITH THE + SIGN

6 - U4 IS TO BE INSERTED INTO SOCKET AFTER COMPLETION OF SOLDERING AND FLUX REMOVAL OPERATIONS.

7 - THE LCD IS TO BE ASSEMBLED ONTO THE ITEM 1 (PCB) AFTER COMPLETION OF SOLDERING AND FLUX REMOVAL OPERATIONS. CONTACT AREA MUST BE FREE OF FLUX RESIDUE.

8 - PROTECTIVE TAPE TO BE REMOVED FROM THE FACE OF ITEM 4 BEFORE ASSEMBLING WITH ITEM 5

9 - ENSURE THAT ITEM 2 ARE NOT PINCHED, TWISTED OR OUT OF ALIGNMENT

(R) 10 - TORQUE ITEM 7 SCREWS TO 2-3 IN-LB. TORQUE ITEM 15 SCREWS TO 1.5 IN-LB.

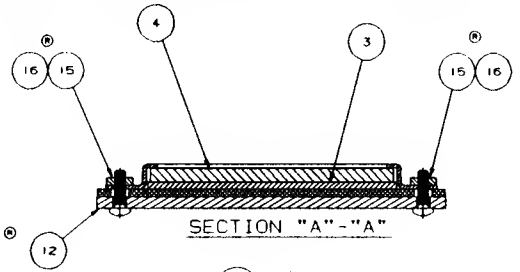
11 - ITEM 4 TO BE ORIENTED ON ITEM 1 WITH INDICATOR LINE AS SHOWN.

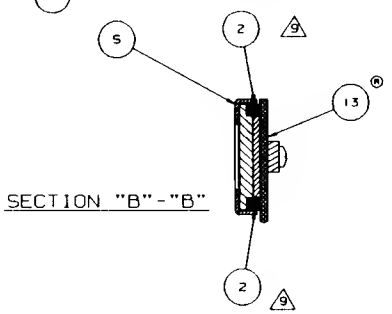
12 - BOARD TO BE SHIPPED IN ELECTRO STATIC DISCHARGE PROTECTIVE WRAP.

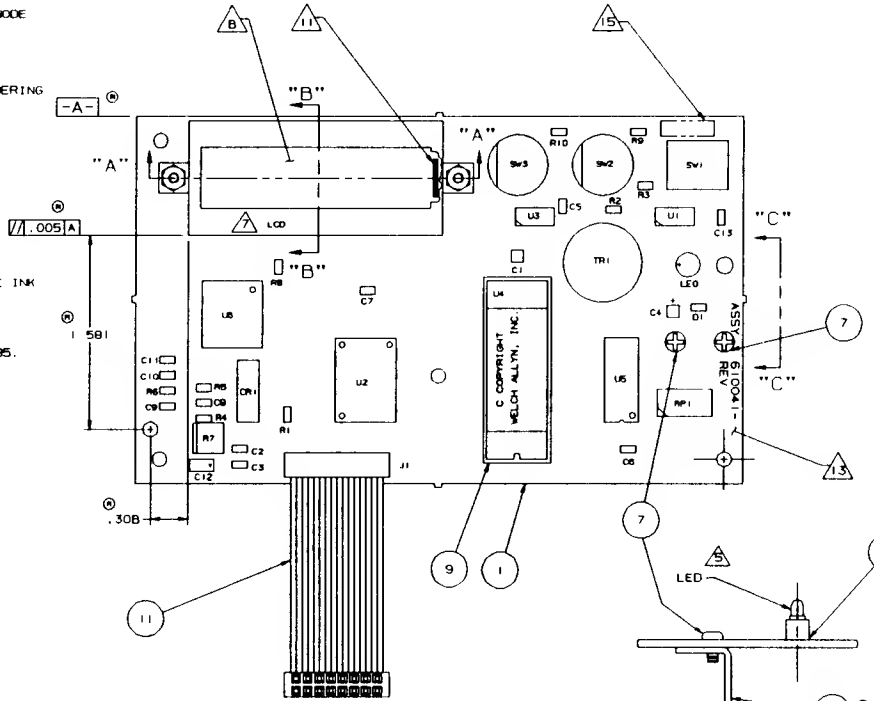
13 - ASSEMBLY NUMBER AND REVISION TO BE MARKED IN AREA PROVIDED WITH INDELIBLE INK

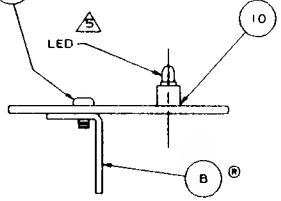
14 - BURN IN PRIOR TO TEST PER 610089.

15 - MARK WITH DATE OF MANUFACTURE.ON REAR SIDE OF BOARD IN AREA SHOWN DATE TO BE CODED AS "YYWW"WHERE YY IS YEAR AND WW IS WEEK PER MIL STD 1285.









THIS DWG-504	DIGITAL PCB W/VER 3.5 S.W. REV T & ABOVE
(S) THIS DWG-503	DIGITAL PCB ASSY W/ CARBON CONTACTS
(R) THIS DWG-502	DIGITAL PCB ASSY W/ CARBON CONTACTS
(L) THIS DRW-501	DIGITAL PCB ASSEMBLY

QTY 504	QTY 502	QTY 501	ITEM OR SYMBOL	PART NUMBER	DESCRIPTION

LIST OF MATERIAL

MATERIAL: FINISH:

UNLESS OTHERWISE SPECIFIED: METRIC DIMENSIONS (WHEN USED) ARE IN ( ) DIMENSIONS INCLUDE PLATING REMOVE BURRS & SHARP EDGES THREADS ARE UNIFIED SERIES AND INCLUDE PLATING. EXTERNAL THDS = CLASS-2 A INTERNAL THDS = CLASS-2 B

MANUFACTURING TOLERANCES ON OTHERWISE SPECIFIED

BASIC DIMENSION	.XX	.XXX
UP TO 6	± .02	± .005
ABOVE 6 TO 24	± .05	± .015
ABOVE 24	± .08	± .010

ANGLES, ± 1/2 DEGREE

DO NOT SCALE

NEXT ASSY	QTY	USED ON

GROUP OR PART

APPLICATION

DRAWN	M. MOONEY	DATE 11/13/89
CHECKED	K. BURDICK	10-11-89
APPROVED	JVL	10-11-89
REL FOR PROD	BC	10-12-89

WELCH ALLYN, INC.
SKANEATELES FALLS, N.Y. U.S.A.

TITLE: DIGITAL PCB ASSEMBLY

CODE IDENT 04478 | SIZE D | DRAWING NO 610041 | REV T

SCALE 2:1 | SHEET 1 OF 1

610051 U

NOTES:

1 - COMPONENTS ARE TO BE LOCATED AS SHOWN, AND MOUNTED SO AS TO MINIMIZE THE DISTANCE BETWEEN THE COMPONENTS AND ITEM 1 (PCB).

⑤ 2 - COMPONENTS U1, U12, U13, ITEM 18, AND ITEM 19 ARE TO BE WAVE SOLDER ATTACHED TO ITEM 1 (PCB) USING EUTECTIC SOLDER. ALL OTHER COMPONENTS EXCEPT FOR ITEMS 2, 3, 6, 7, 17, 14, C32 AND 20 ARE TO BE REFLOW SOLDERED ON TOP OF ITEM 1 (PCB) USING THE APPROPRIATE SOLDER PASTE.

Ⓟ⑤ 3 - A FREON SOLUBLE FLUX IS TO BE USED DURING THE SOLDERING OPERATIONS. FLUX REMOVAL AFTER MACHINE SOLDERING, SHOULD BE DONE USING A FREON TMS SOLUTION. BE SURE THAT THE ASSEMBLY IS FREE OF ANY RESIDUAL CLEANING FLUID.

⑤ 4 - MIGH IMPENDANCE CIRCUITRY REQUIRES WELL CLEANED BOARDS. SURFACE LEAKAGE RESISTANCE MUST BE GREATER THAN 5 X 10⁹ OHMS AT 90% RELATIVE HUMIDITY. BOARD MUST BE THOROUGHLY VAPOR DEGREASED AFTER MACHINE SOLDERING TO ACHIEVE THIS LEVEL OF CLEANLINESS. BRUSH CLEANING CAN SERIOUSLY DEGRADE PERFORMANCE AND IS NOT PERMITTED.

⑤ 5 - ITEMS 2, 3, 6, 7, 17, C32, 14 AND 20 ARE TO BE HAND SOLDERED TO ITEM 1 (PCB) USING EUTECTIC SOLDER RATED L3NC PER IPC-S-815B (ALPHA TELECORE OR EQUIVALENT). THESE COMPONENTS CANNOT BE WAVE SOLDERED. NO CLEANING IS PERMITTED ON ASSEMBLIES CONTAINING ITEMS 2, 3, 6, 7, 17, 14, C32 AND 20.

△6 - ITEM 17 TO BE PROTECTED FROM CLEANING SOLVENTS ENTERING PRESSURE PORTS DURING CLEANING OPERATIONS. TRIM LEADS TO .08 MAX AFTER ASSEMBLY

△7 - ITEMS 2, 3, 6 AND 7 TO BE ATTACHED TO TOP SIDE OF ITEM 1 (PCB).

8 - TOLERANCING IN ACCORDANCE WITH ANSI Y14.5.

9 - BOARD TO BE SHIPPED IN ELECTROSTATIC DISCHARGE PROTECTIVE WRAP.

△10 - PLACE ITEM 21 BETWEEN ITEM 1 (PCB) AND ITEM 20 BEFORE SOLDERING ITEM 20 TO ITEM 1. 45° CORNER ON ITEM 21 TO BE ORIENTED TOWARD R17 AS SHOWN.

△11 - MARK ASSEMBLY LEVEL AND REVISION IN INDICATED LOCATION USING INDELIBLE INK.

△12 - MARK DATE OF MANUFACTURE AS "YYWW" WHERE "YY" IS THE YEAR AND "WW" IS THE WEEK OF YEAR PER MIL STD 1285.

△13 - MAXIMUM EXPOSED LEAD MEASURED WITH TUBING PUSHED TO OTHER END.

14 - BURN IN PRIOR TO TEST PER 610089.

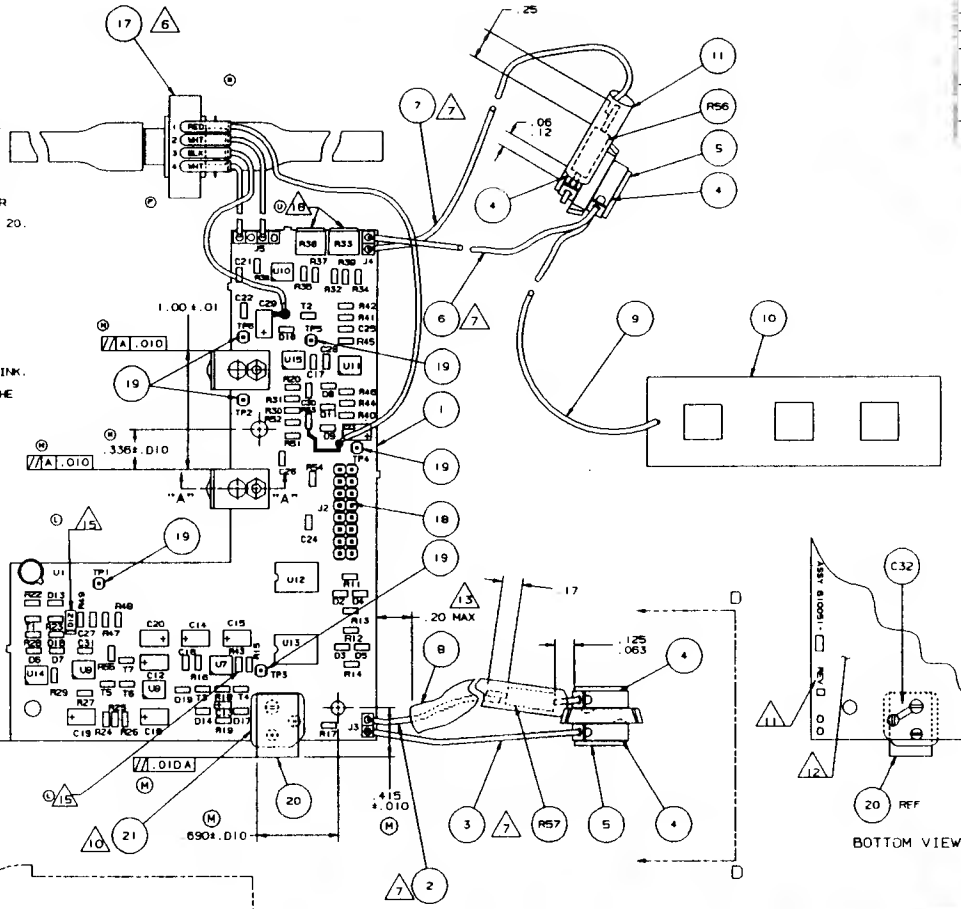
Ⓛ △15 - INSTALL D12 PER VIEW A, AND R43 PER VIEWS B & C. LEADS MUST NOT EXTEND MORE THAN .050 BELOW BOARD.

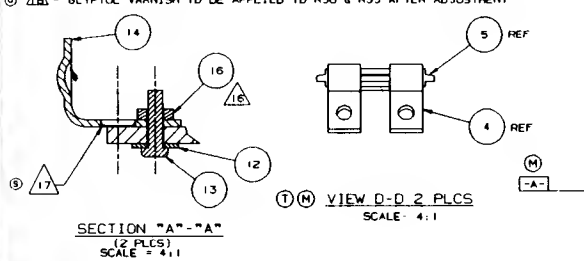
ⓂⓈ△16 - TORQUE TO 13 TO 16 IN-OZ PRIOR TO ITEM 14 SOLDERING.

⑤ △17 - ITEM 14 TO BE HAND SOLDERED TO ITEM 1 WITH ADEQUATE WETTING OF ITEM 1 SOLDER PAD AND CONCAVE SOLDER FILET AS SHOWN.

Ⓤ △18 - GLYPTOL VARNISH TO BE APPLIED TO R36 & R33 AFTER ADJUSTMENT

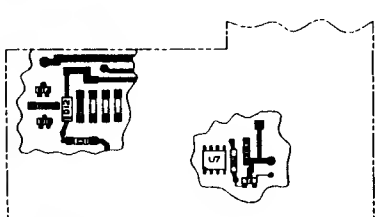
REV	REVISION DESCRIPTION	ECN	INIT	DATE	APPROVAL
P	REL TO W.A. PROD ENG	8613	CPW	10/11/89	JVL
L	DWG TO SHOW 5 REF, ADD D12 W.A., NOTE 15, 17, 18 CTS. VIEWS A, B & C	8761	CPW	1/5/90	K. BURDICK 1-18-90
M	ADDED NOTE 18, .415, .890, VIEW D-D	8817	RDB	2-5-90	K BURDICK
P	REV'D ITEM 4 & B/M	8907	CPW	3/28/90	JVL
P	REV'D ITEM 17 & NOTE 3	8976	CPW	4/24/90	K BURDICK
P	ADD'D THIS DWG-503, MOVED LOCKING ON ITEM 17	9088	CPW	7/20/90	K BURDICK
S	ADDED -9002 & NOTE 17 REM'VD ITEM 19 REV'D ITEM 14, NOTES 2, 3, 4, 9, 16	9301	SMB	6/21/91	JVL
T	CHAMFER ORIENTATION OF KEYED CONNECT CONTACTS SEE VIEW D-D	9419	SMB	4/7/94	JVL
U	ADDED NOTE 18	9575	TW	1/5/95	



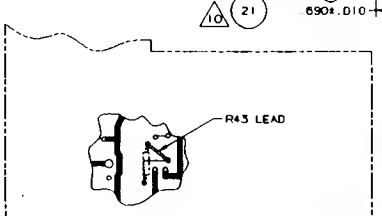


SECTION "A"-"A"
(2 PLCS)
SCALE = 4:1

ⓉⓂ VIEW D-D 2 PLCS
SCALE 4:1



VIEW A Ⓛ



VIEW B Ⓛ

VIEW C Ⓛ
BOTTOM SIDE

Ⓢ	THIS DWG-503 ANALOG PCB ASSEMBLY-REV S AND ABOVE
Ⓡ	THIS DWG-502 ANALOG PCB ASSEMBLY-REV R AND ABOVE
	THIS DWG-501 ANALOG PCB ASSEMBLY

PART NUMBER	DESCRIPTION
	LIST OF MATERIAL

MATERIAL:
FINISH:
UNLESS OTHERWISE SPECIFIED:
METRIC DIMENSIONS (MM) ARE IN ( )
DIMENSIONS INCLUDE PLATING
REMOVE BURRS & SHARP EDGES
THREADS ARE UNIFIED SERIES AND INCLUDE PLATING:
EXTERNAL THDS - CLASS 2 A
INTERNAL THDS - CLASS 2 B
UNLESS OTHERWISE SPECIFIED TOLERANCES ON:

BASIC DIMENSION	.XX	.XXX
UP TO 6	± .02	± .005
OVER 6 TO 24	± .03	± .010
ABOVE 24	± .05	± .015

ANGLES ± 1/2 DEGREE

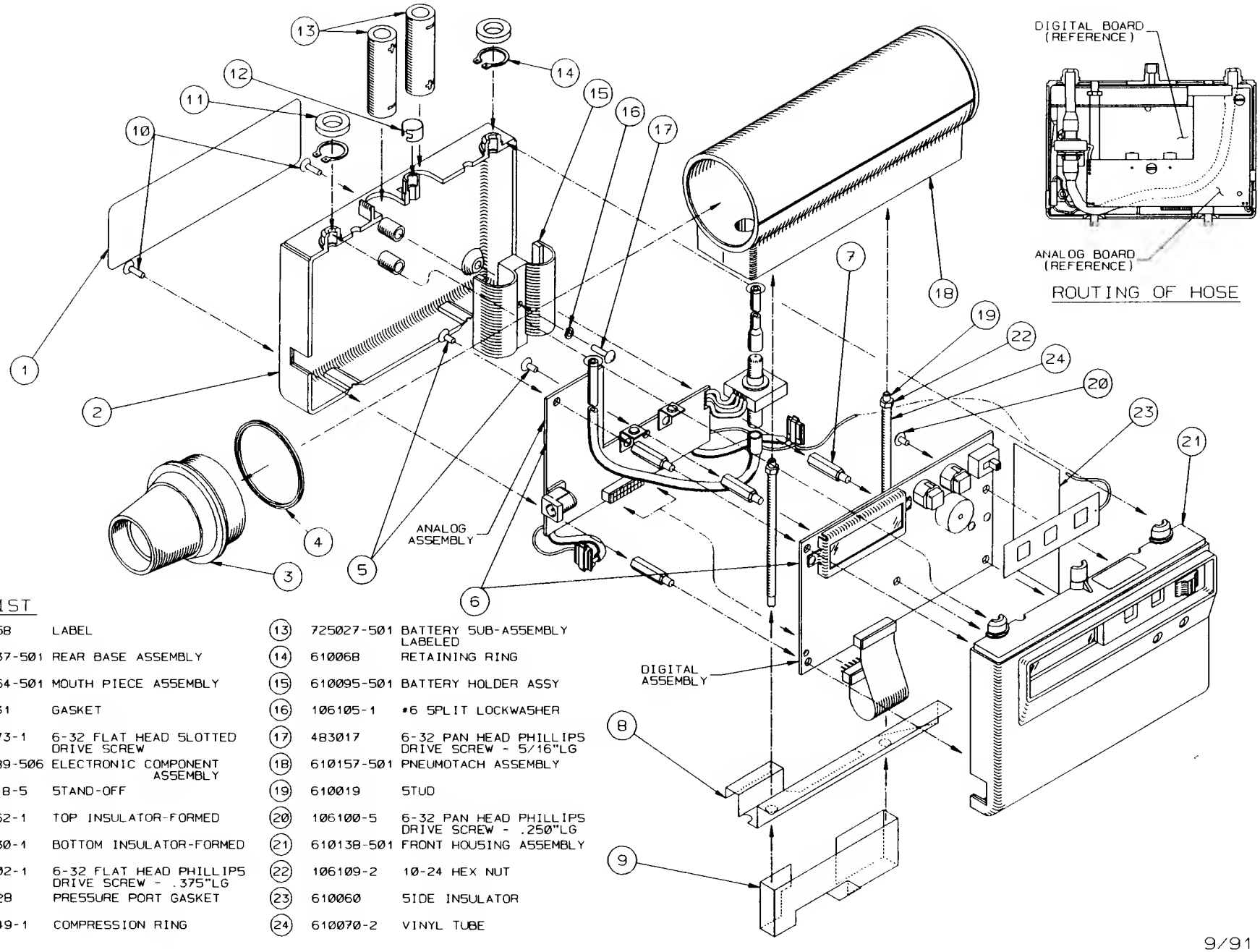
GROUP OR PART | NEXT ASSY | QTY | USED ON
APPLICATION
DO NOT SCALE

DRAWN M. MOONEY 1/13/89
CHECKED K BURDICK 10/11/89
APPROVED JVL 10/11/89
MFG APPR
ENGR APPR
REL FOR PROD BC 10/12/89

WELCH ALLYN, INC.
SKANEATELES FALLS, N.Y. U.S.A.

TITLE: ANALOG PCB ASSEMBLY

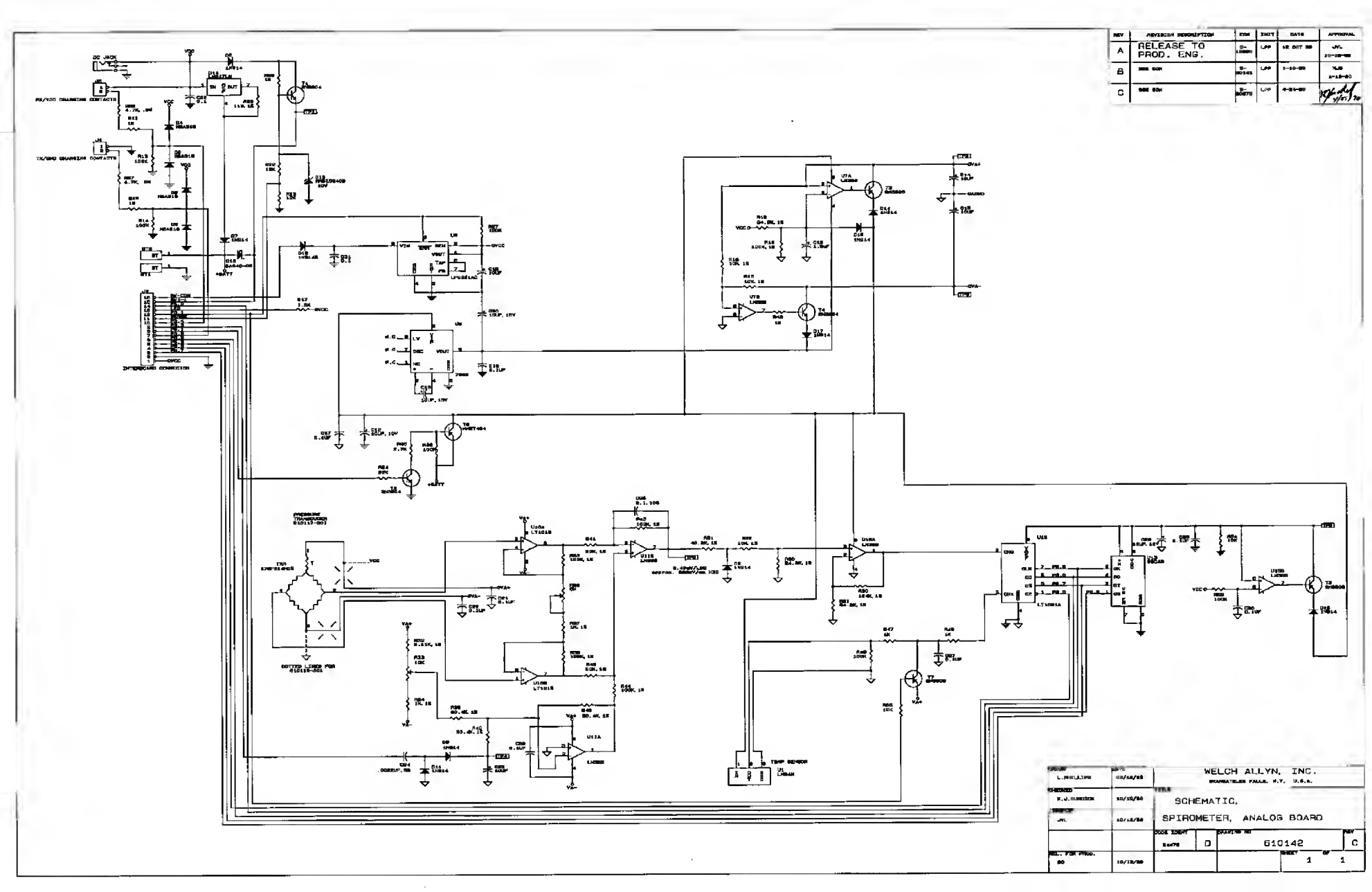
SIZE D | DRAWING NO. 610051 | REV U
SCALE 2/1 | SHEET 1 OF 1



ITEM LIST

1	61005B	LABEL	13	725027-501	BATTERY SUB-ASSEMBLY LABELED
2	610137-501	REAR BASE ASSEMBLY	14	61006B	RETAINING RING
3	610064-501	MOUTH PIECE ASSEMBLY	15	610095-501	BATTERY HOLDER ASSY
4	610031	GASKET	16	106105-1	#6 SPLIT LOCKWASHER
5	610073-1	6-32 FLAT HEAD SLOTTED DRIVE SCREW	17	4B3017	6-32 PAN HEAD PHILLIPS DRIVE SCREW - 5/16"LG
6	6100B9-506	ELECTRONIC COMPONENT ASSEMBLY	18	610157-501	PNEUMOTACH ASSEMBLY
7	76101B-5	STAND-OFF	19	610019	STUD
8	610062-1	TOP INSULATOR-FORMED	20	106100-5	6-32 PAN HEAD PHILLIPS DRIVE SCREW - .250"LG
9	610130-1	BOTTOM INSULATOR-FORMED	21	610138-501	FRONT HOUSING ASSEMBLY
10	106102-1	6-32 FLAT HEAD PHILLIPS DRIVE SCREW - .375"LG	22	106109-2	10-24 HEX NUT
11	610028	PRESSURE PORT GASKET	23	610060	SIDE INSULATOR
12	610049-1	COMPRESSION RING	24	610070-2	VINYL TUBE

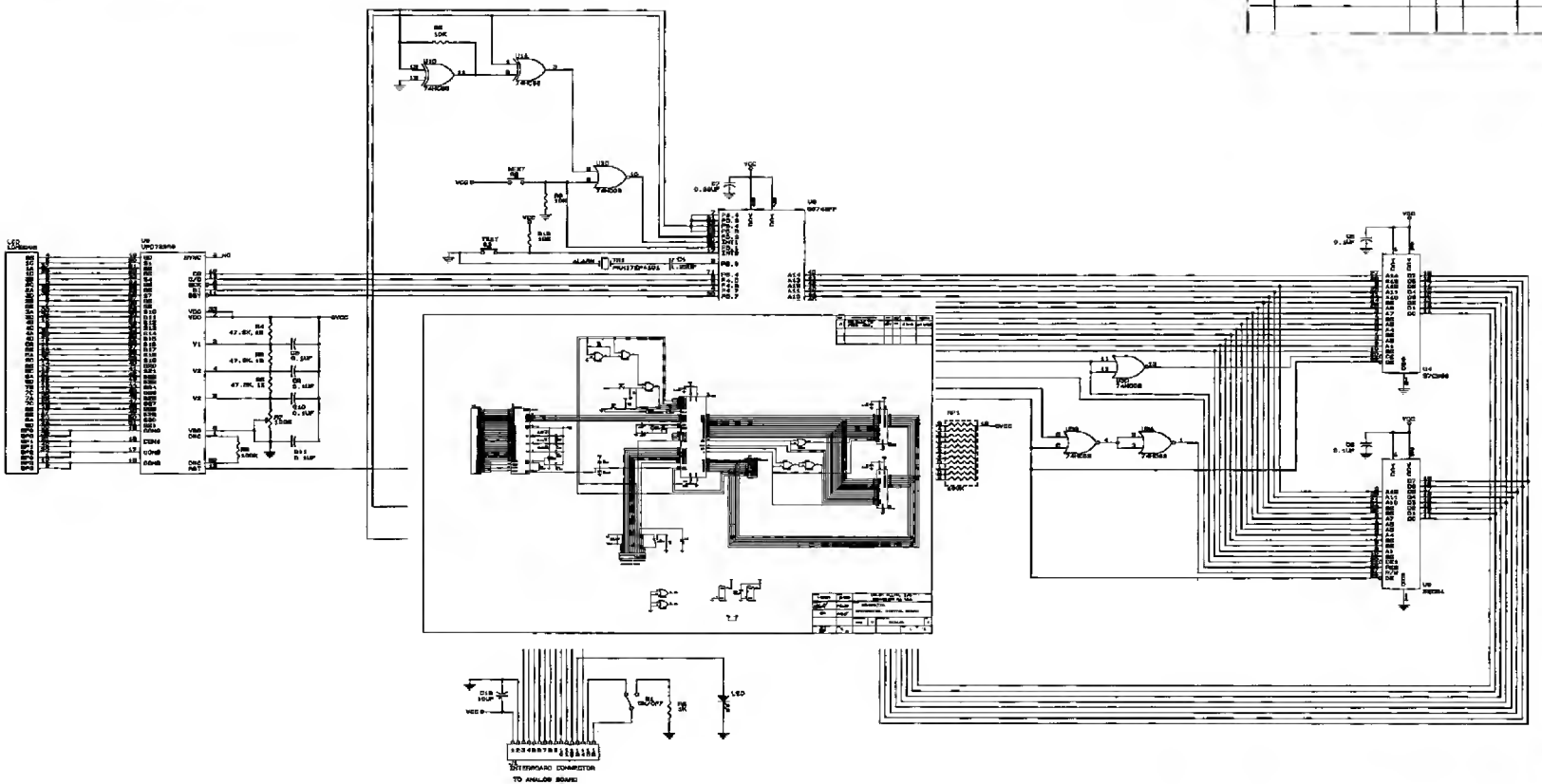
9/91



REV	REVISION DESCRIPTION	ECN	INIT	DATE	APPROVAL
A	RELEASE TO PROD. ENG.	S-10880	LPP	12 OCT 89	JVL 10-12-89
B	[illegible]	S-10945	LPP	1-10-90	JVL 1-10-90
C	[illegible]	S-10978	LPP	4-24-90	[signature] 5/01/90

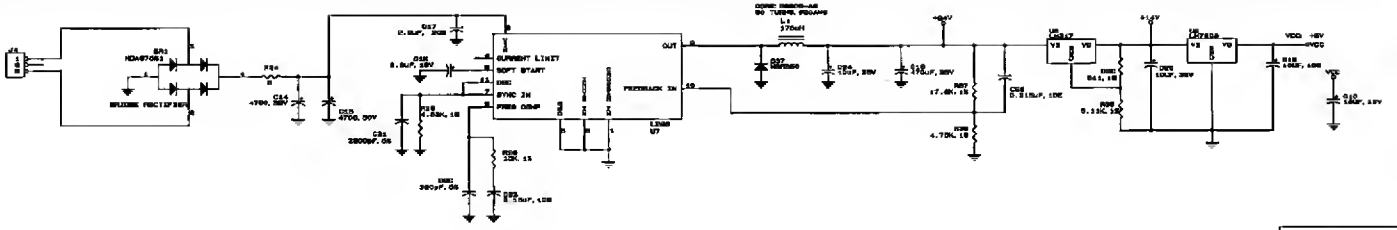
DRAWN L.PHILLIPS	09/28/89	WELCH ALLYN, INC. SKANEATELES FALLS, N.Y. U.S.A.
ENGINEER K.J.HERRICK	10/10/89	TITLE SCHEMATIC, SPIROMETER, ANALOG BOARD
APPROVED JVL	10/12/89	DOCUMENT TYPE 80478 SIZE D DRAWING NO 610142 REV C
RELEASED FOR PROD. 80	10/12/89	SHEET 1 OF 1

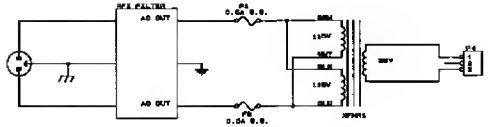
REV	REVISION DESCRIPTION	ECN	INIT	DATE	APPROVAL
A	RELEASE TO PROD. ENG.	S-3917	LPP	12 Oct 89	

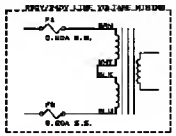


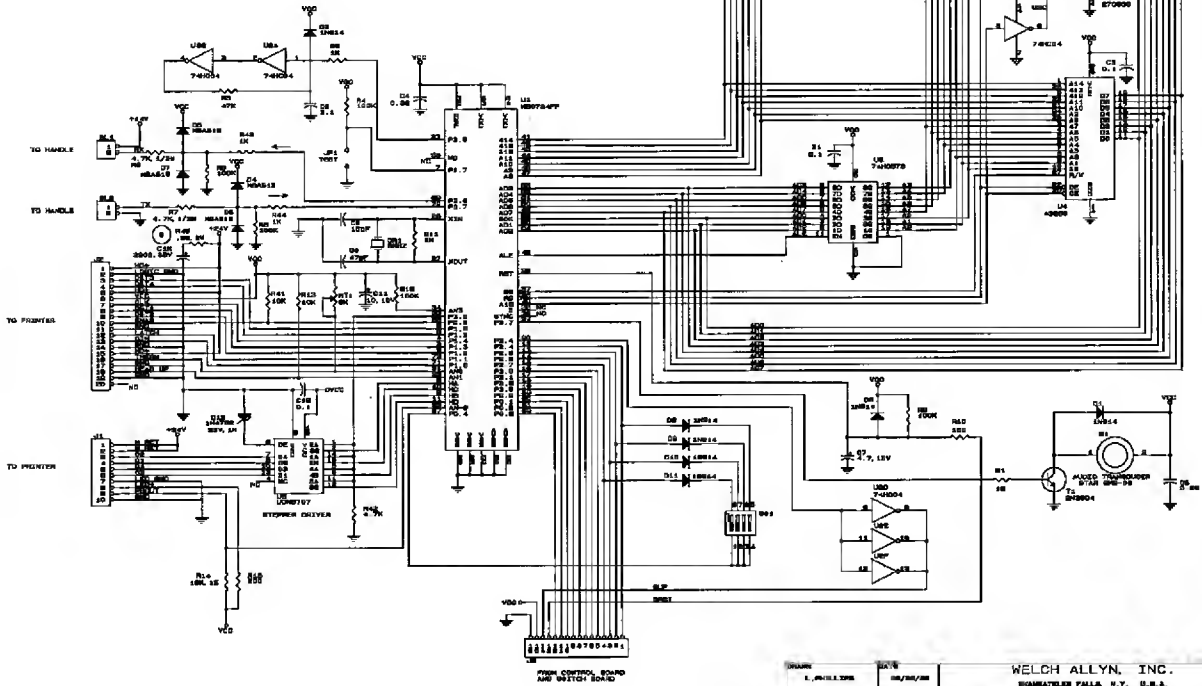
DRAWN: L.PHILLIPS	DATE: 10/12/89	WELCH ALLYN, INC. SKANEATELES FALLS, N.Y. U.S.A.	
ENGINEER:	10/13/89	TITLE: SCHEMATIC, SPIROMETER, DIGITAL BOARD	
APPROVED: JVL	10-12-89		
		SIZE: D	DRAWING NO.: 610143 REV: A
MFG. FOR PROD.	10/12/89		SHEET 1 OF 1

REV	REVISION DESCRIPTION	ECN	INIT	DATE	APPROVAL
A	RELEASE TO PROD. ENG.		LPP	28 OCT 88	JVL
B	.33 WAS .5 (R43)		LPP	5-30-89	JVL 6-1-89
C	0.05A WAS 0.08A		LPP	8-9-90	JVL 8-9-90
D	#16 WAS #18 #27 WAS 0.1uF		DES	7 NOV 90	



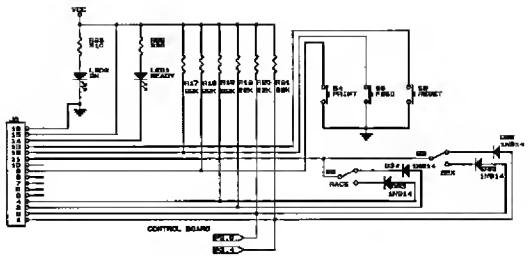


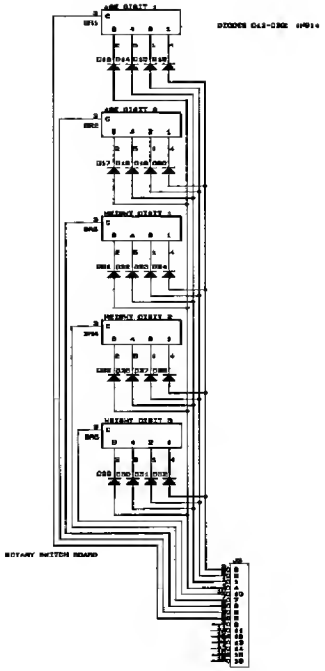




DRAWN	DATE	WELCH ALLYN, INC.	
CHECKED		SCHEMATIC.	
ENGINEER		SPIROMETER PRINTER BOARD	
		CODE IDENT. 06426	DRAWING NO. 761143 REV D
REL. FOR PROD.		SHEET 1 OF 2	

REV	REVISION DESCRIPTION	DSN	CHKD	DATE	APPROVAL
A	RELEASE TO PROD. ENG.	[illegible]	LMP	10 Oct 89	[illegible]





DRAWN L.PHILLIPS	DATE 08/28/89	WELCH ALLYN, INC. SKANEATELES FALLS, N.Y. U.S.A.
ENGINEER	9/10/89	SCHEMATIC, SPIROMETER PRINTER BOARD
MFG.	10-12-89	
		CAGE IDENT 84478 / D / DRAWING NO. 761143 / REV A
MFG. PLAN PROD.	10 12 89	SHEET 2 OF 2

761021 AC

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REV	REVISION DESCRIPTION	ECN	INIT	DATE	APPROVAL
L	RELEASE TO PROD ENG.	2-10966	RDB	10-11-89	JVL
N	REVISED PER US	2-10966	RDB	11-28-89	JVL
N	REV'D. 2380198, 2380188, 7610120, 7610068, 7610094, 2360766-16 & -27, 7611144	2-11111	SB	1-8-90	K BURDICK 1-19-90
P	ADDED SIDE VIEW OF J1, J2, C14, & C15. ADDED NOTES 18 & 19. DEL. NOTES 9 & 14. VIEW C-C AND ITEM 18 SH 2. REVISED DRW 8101D2 PER REV C.	2-11416	RDB	2-5-90	K BURDICK 2/6/90
R	ADD'D NOTE 21, REV'D NOTE 16, DELETED ITEM 17 OF U4 (-04), 7611045 (-505 7610081 (-507), REV'D SHEET 2	2-11446	DRW	2/28/90	KJB
S	REV'D NOTE 18 & ITEM 21; ADD'D NOTE 20	2-11500	DRW	3/29/90	JVL
T	ADD'D -506, -507 & -508 TO QUANTITY TO (4), 18 (4), 19 (4), 21 (4) & ADD'D NOTE 18; ADD'D NOTE 21 & ITEM 18	2-11588	DRW	11/1/90	K BURDICK
U	REV'D NOTE 18, ADD'D NOTE 22 & THIS DWG 505	2-11638	DRW	2/3/91	JVL
V	ADDED THIS DRW -508	2-11700	SRS	7/30/92	KJB
W	ADD ALTERNATE VIEW OF U8	2-11818	SRS	12/29/92	KJB
Y	REVISED ITEMS: 4, 11, & 22 PICTORIALLY CHANGED: -505 TO -507 & -508 TO -508 REMOVED: -501, -502, -504	2-11907	SRS	8/7/93	JVL
Z	REV'D NOTE 21	2-12126	SB	1-11-95	JVL
AA	UPDATED REV LETTER	2-12166	SB	4-10-95	SJS
AB	ADD'D ALTERNATE WDGONG TO 761101, 761112 & 761097	2-12216	DRW	4/19/95	KJB 4/30/95
AC	ADD TOSHIBA TO 761097	2-12236	TV	8/3/95	

NOTES:

1 - COMPONENTS ARE TO BE LOCATED AS SHOWN, AND MOUNTED SO AS TO MINIMIZE THE DISTANCE BETWEEN THE COMPONENTS AND ITEM 1 (PCB).

(T) 2 - THRU LEAD COMPONENTS ARE TO BE WAVE OR HAND SOLDERED TO ITEM 1 USING 60/40 OR EUTECTIC SOLDER. ITEM 20, BOTTOM MOUNTED PARTS (RT1, J1, J2), AND PARTS WHICH ARE NOT SEALED AGAINST CLEANING SOLVENTS (X1, ITEM 12) MUST BE HAND SOLDERED. ALL SURFACE MOUNT PARTS ARE TO BE REFLOW SOLDERED TO ITEM 1 USING THE APPROPRIATE SOLDER PASTE.

(T) 3 - AFTER MACHINE SOLDERING OPERATIONS, ASSEMBLY IS TO BE CLEANED TO IPC-S-815B, DECEMBER 1987 CLASS II STANDARDS, CLEANING DESIGNATOR C14D OR C24D. CLEANING AFTER WAVE SOLDERING TO BE WITH FREON TMS OR OTHER WELCH ALLYN APPROVED PROCESS. CLEANING AFTER REFLOW TO BE DONE WITH WATER OR OTHER WELCH ALLYN APPROVED PROCESS. ASSEMBLY TO BE FREE OF CLEANING FLUID PRIOR TO TESTING.

(T) 4 - HAND SOLDERING OPERATIONS ARE TO BE DONE USING A EUTECTIC SOLDER RATED L3NC PER IPC-S-815B (ALPHA TELECORE OR EQUIVALENT). ASSEMBLIES ARE NOT TO BE CLEANED AFTER HAND SOLDERING.

(W)(T) 5 - CUT COMPONENT LEADS TO .050 MAX ON U6, U7, U8, U9, R8, D37, C16 AND L1 AFTER SOLDERING.

(T) 6 - AFTER CLEANING OPERATIONS HAVE BEEN COMPLETED, SOLDER ITEM 12 TO ITEM 1 AS REQUIRED.

(T) (NOTE 7 DELETED IN REVISION T)

8 - TOLERANCING IN ACCORDANCE WITH ANSI Y14.5.

(R) 9 - TORQUE ITEM 7 TO 3.5 - 4.5 IN LBS

(P) (NOTE 10 DELETED IN REVISION P)

11 - TEST JUMPER MUST BE REMOVED AFTER BOARD TESTING

(T) 12 - PC BOARD TO BE SHIPPED IN ESD PROTECTIVE PACKAGING

(T) 13 - ITEM 17 TO PASS THROUGH L1 AND TERMINATE WITHIN L1. SHRINK ITEM 16 ONTO L1 AFTER ATTACHING ITEM 17. ITEM 16 MUST NOT EXTEND ABOVE L1.

(P) 14 - TORQUE ITEM 22 TO 1.5 - 2.0 IN LBS.

15 - ASSEMBLY LEVEL (eg:501) AND REVISION LEVEL TO BE MARKED WITH INDELIBLE INK IN THIS AREA

(W) 16 - INSTALL U5 AFTER CLEANING

17 - BURN IN PRIOR TO TEST- 24 HOURS AT 60°C UNDER POWER UP CONDITIONS (40VDC AT J4).

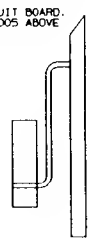
(P) 18 - LACING TAPE KNOT MUST BE BELOW TANGENT PLANE. LACING MUST HOLD CAPACITORS FIRMLY AGAINST BOARD TO PREVENT THEM FROM MOVING AROUND. CUT OFF EXCESS LACING AFTER KNOT HAS BEEN TIED.

(T)(P) 19 - FLARE ITEM 19 PER MFG SPECIFICATIONS. SOLDER ITEMS 19 ON BOTTOM 4 PLCS BEFORE MOUNTING ITEMS 4

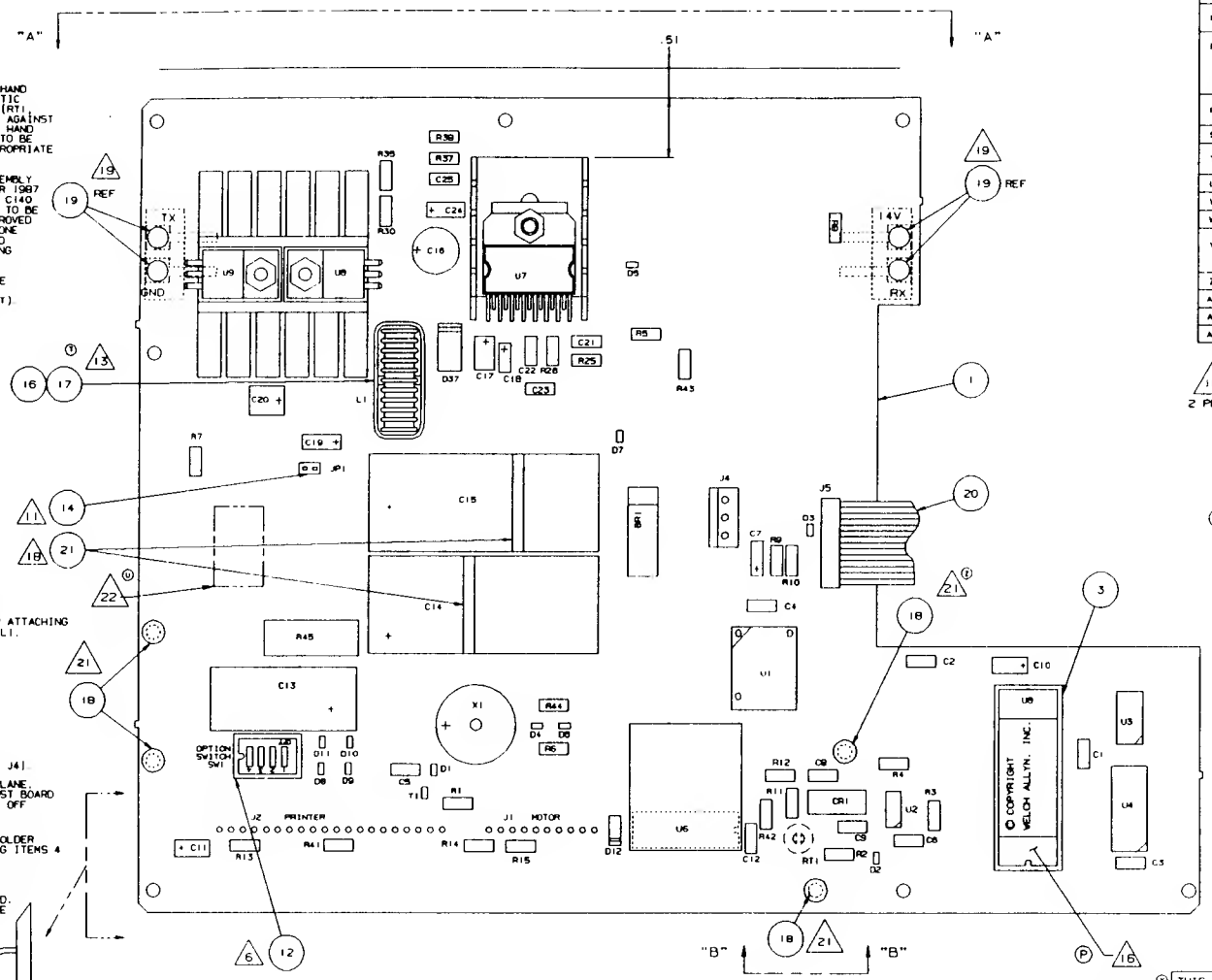
(S) 20 - C14 AND C15 MUST BE FLUSH AGAINST THE BOARD BEFORE AND AFTER SOLDERING.

21(T) 21 - SOLDER ITEMS 18 (4 PLCS) TO CIRCUIT BOARD. SOLDER BUILDUP MUST NOT EXCEED .005 ABOVE TOP OF ITEM 18.

(T)(T) 22 - MARK WITH DATE OF MANUFACTURE AS "YYWW" WHERE YY IS YEAR AND WW IS WEEK PER MIL STD 1285.



(R) (P) SCALE 4:1



J1 AND J2 REF

①	THIS DRW-508	MAIN PCB ASSY-PRINTER, FINLAND(ONLY)		
①	THIS DRW-507	MAIN PCB ASSY - PRINTER		
	PART NUMBER	DESCRIPTION		

LIST OF MATERIAL

QTY 504	QTY 503	QTY 502	QTY 501	ITEM OR SYMBOL

MATERIAL: N/A FINISH: N/A

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ON: BASIC DIMENSION .XX ±.02, .XXX ±.005; UP TO 6 ±.02 ±.005; ABOVE 6 TO 24 ±.03 ±.010; ABOVE 24 ±.06 ±.015; ANGLES ± 1/2 DEGREE. DO NOT SCALE.

METRIC DIMENSIONS (MM) USED ARE IN ( ). DIMENSIONS INCLUDE PLATING. REMOVE BURRS & SHARP EDGES. THREADS ARE UNIFIED SERIES AND INCLUDE PLATING. EXTERNAL THDS = CLASS 2 A. INTERNAL THDS = CLASS 2 B.

GROUP OR PART	NEXT ASS'Y	QTY	USED ON
	APPLICATION		

DRAWN	H MOONEY	2/27/90
CHECKED	K BURDICK	10-12-89
APPROVED	JVL	10-12-89
REL FOR PROD	BC	10-12-89

WELCH ALLYN, INC.
SKANEATELES FALLS, N.Y. U.S.A.

TITLE: MAIN PCB ASSY-PRINTER

CODE IDENT NO 04478 | SIZE D | DRAWING NO 761021 | REV AC

SCALE 2:1 | SHEET 1 OF 2

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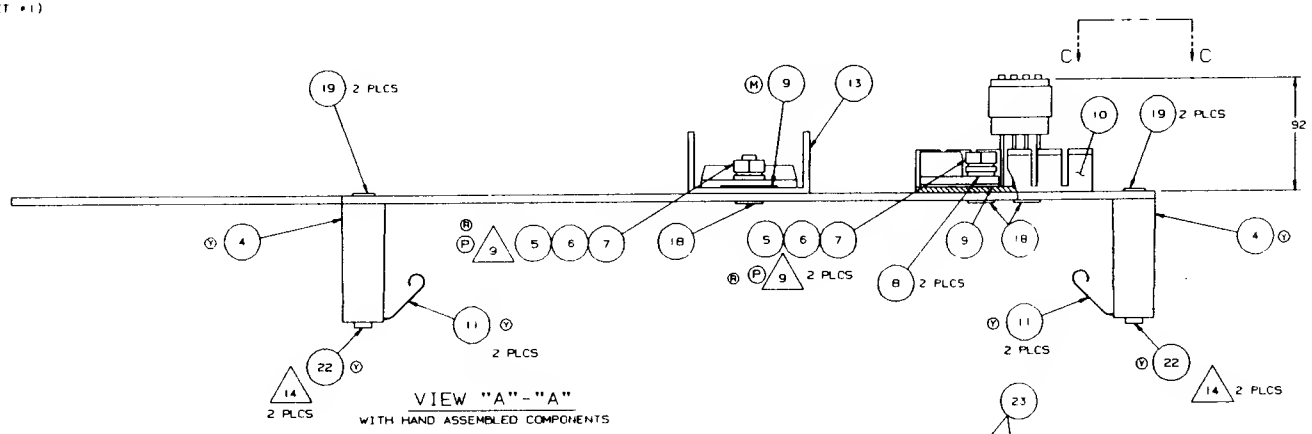
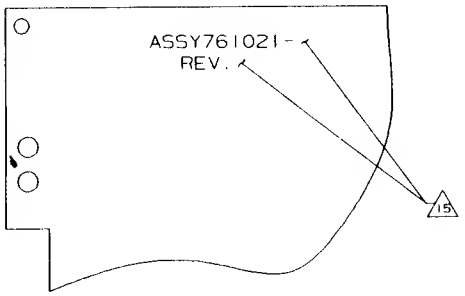
REV	REVISION DESCRIPTION	ECN	INIT	DATE	APPROVAL
L	RELEASE TO PROD. ENG.	10844	ROB	10-11-89	JWL 10-12-89
P	DEL ITEM 18 NOTE 9 TO 14 ADDED BOTTOM VIEW.	10915	ROB	2-5-90	KJB 10-12-89
R	4 WAS 14	10948	CRW	2/8/90	KJB 2-8-90
Y	REVISED ITEM 4,11,& 22 PICTORIALLY	21089	SRS	9-7-93	JWL 9-7-93

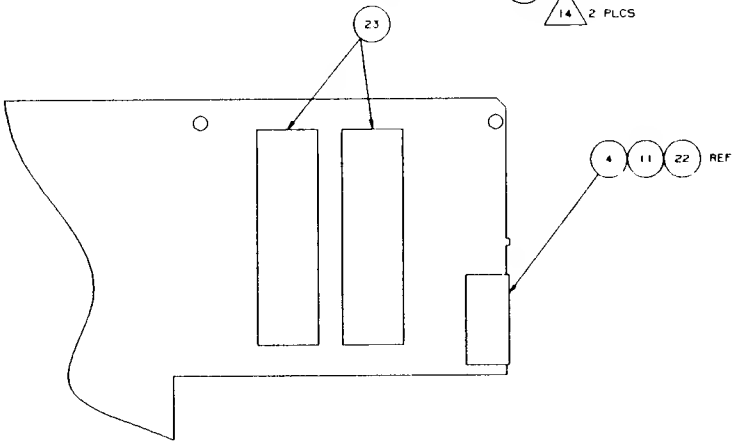
NOTES:
(SEE SHEET #1)

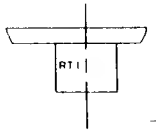


VIEW "A"-"A"
WITH HAND ASSEMBLED COMPONENTS



VIEW C-C





VIEW "B"-"B"
SCALE 4/1

QTY 1004	QTY 1003	QTY 1002	QTY 1001	ITEM OR SYMBOL	DESCRIPTION
				THIS DRW-501	MAIN PRINTER PCB ASSEMBLY
				PART NUMBER	LIST OF MATERIAL

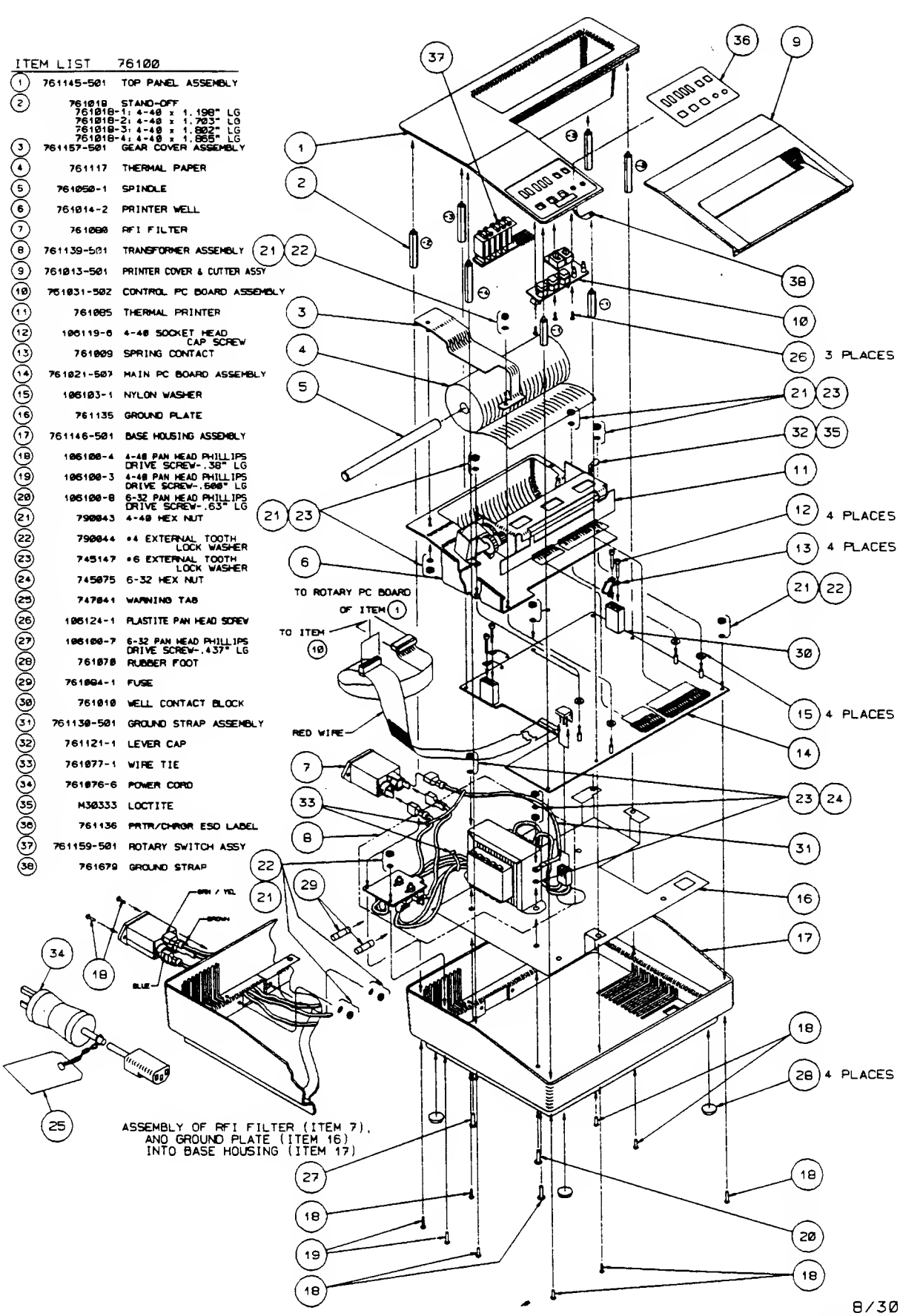
MATERIAL: N/A
FINISH: N/A
REF. DWGS
UNLESS OTHERWISE SPECIFIED:
METRIC DIMENSIONS (WHEN USED) ARE IN [ ]
DIMENSIONS INCLUDE PLATING.
REMOVE BURRS & SHARP EDGES
THREADS ARE UNIFIED SERIES AND INCLUDE PLATING.
EXTERNAL THDS = CLASS-2 A
INTERNAL THDS = CLASS-2 B
GROUP OR PART
NEXT ASSY'
QTY
USED ON
APPLICATION
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON:
BASIC DIMENSION .XX ±.02 .XXX ±.005
UP TO 6 ±.02 ±.005
ABOVE 6 TO 24 ±.08 ±.010
ABOVE 24 ±.08 ±.015
ANGLES: ± 1/2 DEGREE
DO NOT SCALE

DRAWN	M. MOONEY	2/27/89
CHECKED	K. BURDICK	10-12-89
APPROVED	JWL	10-12-89
REL FOR PROD	BC	10-12-89

WELCH ALLYN, INC.
SKANEATELES FALLS, N.Y. U.S.A.
TITLE: ~~PRINTER MAIN PCB~~ ASSEMBLY
CODE IDENT 04478
SIZE D
DRAWING NO. 761021
REV Y
SCALE 2/1
SHEET 2 OF 2

ITEM LIST 76100

1	761145-501	TOP PANEL ASSEMBLY
2	761018	STAND-OFF 761018-1: 4-40 x 1.198" LG 761018-2: 4-40 x 1.703" LG 761018-3: 4-40 x 1.802" LG 761018-4: 4-40 x 1.855" LG
3	761157-501	GEAR COVER ASSEMBLY
4	761117	THERMAL PAPER
5	761050-1	SPINDLE
6	761014-2	PRINTER WELL
7	761008	RFI FILTER
8	761139-501	TRANSFORMER ASSEMBLY
9	761013-501	PRINTER COVER & CUTTER ASSY
10	761031-502	CONTROL PC BOARD ASSEMBLY
11	761005	THERMAL PRINTER
12	106119-6	4-40 SOCKET HEAD CAP SCREW
13	761009	SPRING CONTACT
14	761021-507	MAIN PC BOARD ASSEMBLY
15	106103-1	NYLON WASHER
16	761135	GROUND PLATE
17	761146-501	BASE HOUSING ASSEMBLY
18	106100-4	4-40 PAN HEAD PHILLIPS DRIVE SCREW-.38" LG
19	106100-3	4-40 PAN HEAD PHILLIPS DRIVE SCREW-.500" LG
20	106100-8	6-32 PAN HEAD PHILLIPS DRIVE SCREW-.63" LG
21	790043	4-40 HEX NUT
22	790044	#4 EXTERNAL TOOTH LOCK WASHER
23	745147	#6 EXTERNAL TOOTH LOCK WASHER
24	745075	6-32 HEX NUT
25	747841	WARNING TAB
26	106124-1	PLASTITE PAN HEAD SCREW
27	106100-7	6-32 PAN HEAD PHILLIPS DRIVE SCREW-.437" LG
28	761078	RUBBER FOOT
29	761004-1	FUSE
30	761010	WELL CONTACT BLOCK
31	761138-501	GROUND STRAP ASSEMBLY
32	761121-1	LEVER CAP
33	761077-1	WIRE TIE
34	761076-6	POWER CORD
35	M30333	LOCTITE
36	761136	PRTR/CHRGR ESD LABEL
37	761159-501	ROTARY SWITCH ASSY
38	761079	GROUND STRAP

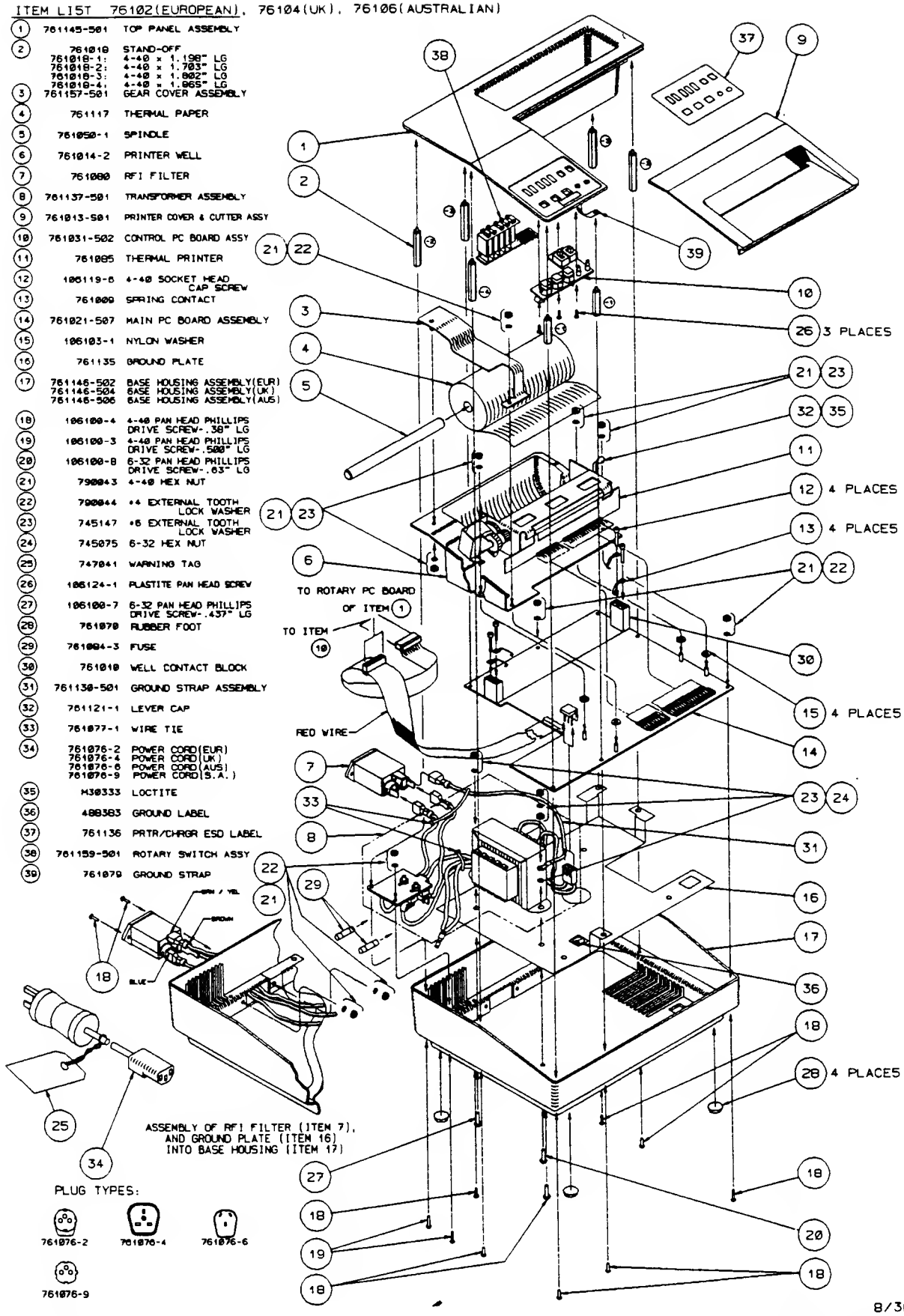


ASSEMBLY OF RFI FILTER (ITEM 7), AND GROUND PLATE (ITEM 16) INTO BASE HOUSING (ITEM 17)

8/30/93

ITEM LIST 76102(EUROPEAN), 76104(UK), 76106(AUSTRALIAN)

1	761145-501	TOP PANEL ASSEMBLY
2	761018	STAND-OFF
	761018-1:	4-40 x 1.198" LG
	761018-2:	4-40 x 1.703" LG
	761018-3:	4-40 x 1.802" LG
	761018-4:	4-40 x 1.865" LG
3	761157-501	GEAR COVER ASSEMBLY
4	761117	THERMAL PAPER
5	761050-1	SPINDLE
6	761014-2	PRINTER WELL
7	761000	RFI FILTER
8	761137-501	TRANSFORMER ASSEMBLY
9	761013-501	PRINTER COVER & CUTTER ASSY
10	761031-502	CONTROL PC BOARD ASSY
11	761005	THERMAL PRINTER
12	106119-6	4-40 SOCKET HEAD CAP SCREW
13	761009	SPRING CONTACT
14	761021-507	MAIN PC BOARD ASSEMBLY
15	106103-1	NYLON WASHER
16	761135	GROUND PLATE
17	761146-502	BASE HOUSING ASSEMBLY(EUR)
	761146-504	BASE HOUSING ASSEMBLY(UK)
	761146-506	BASE HOUSING ASSEMBLY(AUS)
18	106100-4	4-40 PAN HEAD PHILLIPS DRIVE SCREW-.38" LG
19	106100-3	4-40 PAN HEAD PHILLIPS DRIVE SCREW-.500" LG
20	106100-8	6-32 PAN HEAD PHILLIPS DRIVE SCREW-.63" LG
21	790043	4-40 HEX NUT
22	790044	#4 EXTERNAL TOOTH LOCK WASHER
23	745147	#6 EXTERNAL TOOTH LOCK WASHER
24	745075	6-32 HEX NUT
25	747041	WARNING TAG
26	106124-1	PLASTITE PAN HEAD SCREW
27	106100-7	6-32 PAN HEAD PHILLIPS DRIVE SCREW-.437" LG
28	761078	RUBBER FOOT
29	761084-3	FUSE
30	761018	WELL CONTACT BLOCK
31	761138-501	GROUND STRAP ASSEMBLY
32	761121-1	LEVER CAP
33	761077-1	WIRE TIE
34	761076-2	POWER CORD(EUR)
	761076-4	POWER CORD(UK)
	761076-6	POWER CORD(AUS)
	761076-9	POWER CORD(S.A.)
35	M30333	LOCTITE
36	488383	GROUND LABEL
37	761136	PRTR/CHRGR ESD LABEL
38	761159-501	ROTARY SWITCH ASSY
39	761079	GROUND STRAP



8/30/93